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COOP'S TECHNOLOGY DIGEST

-A Timely Report On The *World* Of Communications-

Published as a confidential industry newsletter ten times per year by electronics and technology author *Robert B. Cooper*. All reports source checked for accuracy prior to publication; readers are cautioned to conduct their own verification of data prior to formulating business judgments based upon reports here. Data of unverified authenticity is nominally so-labeled as a guide to reader caution. The publisher draws upon 33 years of leading-edge electronic-industry media experience but can be mislead by those with clever agendas. Subscription and contact information appears at the bottom of this page.

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COOP'S TECHNOLOGY DIGEST

SEPTEMBER 20, 1993 / Volume 93-09

COOP'S TECHNOLOGY DIGEST is published 10 times per year by Robert B. Cooper;

"For the greatest part of human history, the only methods of signaling to distant points depended upon sound or light. The human voice - even aided by the very ingenious modulation techniques employed by Swiss yodelers and Basque mountaineers - carries only one or two kilometres at the most. Jungle drums have a much greater range, which can be extended indefinitely by relaying. However, this reduces the rate of transmission and, even worse, vastly increases the possibility of error.

"The simplest, and perhaps oldest, ways of sending information over long distances were smoke signals during the daytime and beacon fires at night. Both methods were vulnerable to weather and limited in content, being restricted to prearranged messages of the type '*The armada has/has not been sighted*' or '*The British are coming by land/sea*'.

"The world's first regular telegraph network was established in France by Claude Chappe in 1794; the word telegraph, meaning 'writing from afar', had been invented from the Greek just two years earlier. Chappe's system used movable arms on towers in line of sight of each other, and the operators read the messages by means of telescopes. It was clumsy, but effective, and as there was no practical alternative it was soon copied everywhere. Though it lasted only a few decades, it left its mark. There are still many Telegraph Hills on the map.

"But real telecommunication, with virtually no limitations on range, speed, or contents was not possible until mankind had discovered how to produce and control electricity; then, in the span of only three human lifetimes, the world was transformed almost out of recognition.

"And the end is not yet in sight."

These paragraphs, appearing in Arthur C. Clarke's **How The World Was One / Beyond The Global Village** (1), establishes a foundation for the coming decades in telecommunications. Those who take the time to understand the past will be the best equipped to deal with the future. Within the last half-generation three seemingly only partially related technologies have developed rapidly. Now all three seem destined to 'collide' into a single new technology which holds the promise of transforming our planet into a single 'global village'; approximately four decades after the phrase was first coined and Canadian Marshall McLuhan postulated the 'electronic culture'.

The three technologies rushing into a 'menage a trois'? Satellites, computers, and fibre optics. Two of these are transmission mechanisms (the satellite and the fibre optic cable) and the third is

1/ **How The World Was One/Beyond The Global Village**; Bantam Books (Auckland) July 1992 ISBN O-553-07440-7.

the mechanical/electrical tool which allows information to be conveyed over vast distance at great speeds; telecommunications is but a subset of these three basic ingredients. To paraphrase Arthur Clarke, *the end may not be in sight, but a major intersection in the pathway is coming into view.*

THE FIBRE FABRIC

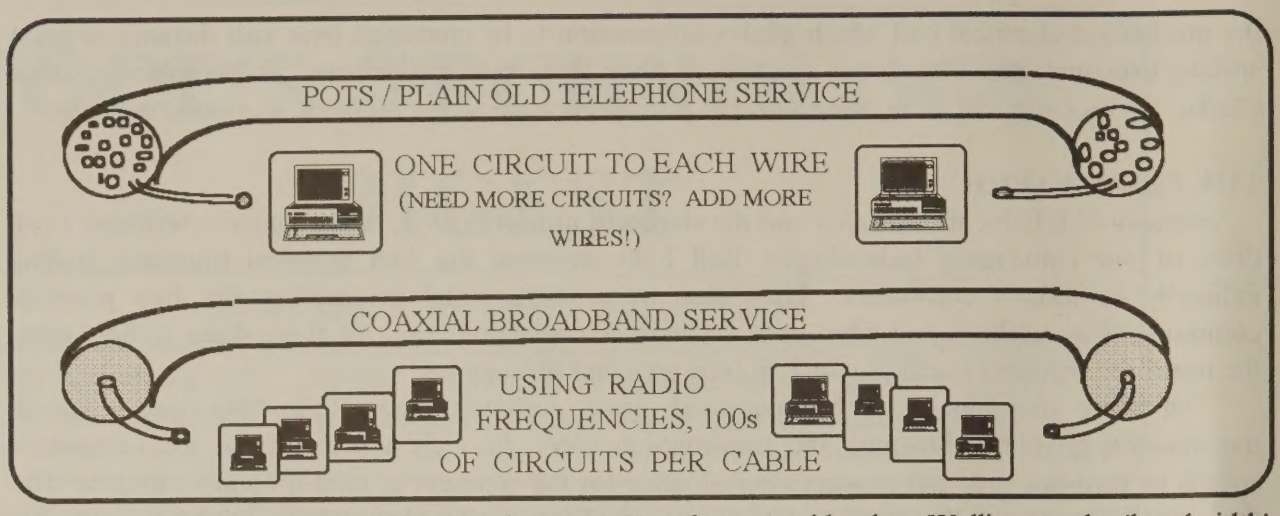
America's Bell Labs, the research and development arm of AT&T, was a major contributor to all three of our converging technologies. Bell Labs invented the first practical transistor leading indirectly to today's computers. They also were instrumental in creating the first practical communication satellites and fibre optic techniques originated here. Of these three technologies, the transistor predated satellites which in turn predated fibre optics.

All three disciplines can be measured using common parameters; transmission speed, transmission quantity (thru-put) and transmission costs. In such a comparison, the computer's speeds or thru-put is of but passing interest since for the moment at least it cannot compete with the overall capacity of the other two in the practical world (the place where individual computer appliances establish the need for transmission circuit thru-put capacity and speed).

Transmission speed has always been directly related to transmission bandwidth. In Claude Chappe's telegraph, speed was limited by mechanical constraints; how fast could the movable arms be rearranged on the transmission towers to form a new character or message? When electrical impulses replaced mechanical arms, the first speed limits were set by the ability of the human mind to decipher the distinction between 'dots' and 'dashes' in the telegrapher's code; and comprehend the text. When electronic machines replaced the human mind, for both sending and receiving, speed was then limited by the ability of the circuits to separate the pulses. Soon thereafter techniques for sending two separate streams of pulses on a single cable were developed, then three, then four; multiplexing had arrived. As the 'bandwidth' of the cables improved, the thru-put capacity of the networks increased. The introduction of television, first via long haul coaxial cables later via microwave in the 1940s, was a major incremental advance for bandwidth. Because of the demands of television for wide bandwidths, Bell Labs was forced to develop 'wideband' transmission techniques. This in turn paved the way for complex analogue schemes allowing the simultaneous transmission of hundreds of separate, distinct 'data streams' through a coaxial or microwave network.

The early computers were more related to Chappe's telegraph than the television of the same era. Data streams were 'narrow' because computations were largely mechanical. Speed was obtained by operating parallel data streams through separate converging circuits rather than through 'broadband' networks. Transistors of the 50's led to integrated circuits of the 60's and computing never looked back.

Fibre optics is all about bandwidth; the amount of data transmitted or conveyed along an information 'highway'. Predating fibre optics was coaxial cable and predating coax were various bundles of wires forming parallel, separate paths between two points. The earliest wires were capable of transmitting electrical pulses but only one pulse or set of pulses at a time. To expand bandwidth, multiple wires were installed between signaling stations. In its most basic form, one wire could transmit one message, two wires two messages, three wires three messages and so on. If you wished 100 simultaneous message circuits between Auckland and London, it took 100 separate wires. Later improvements added the ability to use a single wire for several simultaneous messages; but as the total distance between two points increased, the number of simultaneous messages possible went down. You might manage ten messages per wire between Auckland and



Parnell, or five between Auckland and Taupo. But from Auckland to Wellington the 'bandwidth' of the wires dropped to a single message per wire.

Coaxial cable overcame this limitation. Where POW (plain old wire) bandwidth was restricted to at best a handful of simultaneous messages, coaxial (wire) cable offered bandwidth capable of carrying hundreds, later thousands of separate signaling circuits per cable. The coaxial 'secret' was radio. POW relied on direct electrical circuits; the transmission of voltages on a wire with the voltages 'keyed' on and off in a coded sequence to convey message text. Coaxial cable used not electrical voltages but rather radio signals. Electrical voltages have no 'frequency'; radio signals do. A coaxial cable was capable of transmitting hundreds of separate radio transmissions simultaneously and each of these radio transmissions could independently be 'modulated' with its own 'message text'. In effect, several hundred/thousand tiny 'radio transmitters' were connected to one end of the coaxial cable, and along the way receivers tapped into the cable and were tuned to just one of these 'radio frequencies' at a time; extracting from the cable that frequency, and in turn the information conveyed by that frequency.

Alas, coaxial cable 'bandwidth' was not infinite and to cover long distances (hundreds/thousands of kilometres end to end) the individual radio carriers had to be limited to a few hundred at a time. Still, coaxial gave us national television networking and the telephone company gained the ability to run one cable and transmit hundreds of telephone calls simultaneously.

Bell Labs research and development could have pressed coaxial cable to greatly improved performance and probably would have done so had it not been for the promise of two new technologies by the mid-60s; satellites, and fibre optics. Both offered a quantum leap in 'bandwidth' capacity over coaxial cable as Bell then understood the cable. And at the time when a decision had to be made (pursue further refinements of coaxial cable technology, or 'leap ahead' into satellites and fibre optics), both satellites and fibre optics looked like a better gamble.

(It is worth noting, as we shall explore in **CTD** for 18 January, that another segment of North American technology, the fledgling cable TV industry, elected to stay with refinements of the coaxial networks. Today, the bandwidth of state-of-the-art coaxial networks roughly parallel the bandwidths of fibre optics so with hindsight Bell Labs could have gone in either direction and ended up at about the same place today for short and medium distance transmission.)

Coaxial cable development from the end of World War Two through the present art has been primarily driven by 'television'. Inter city networking forced the initial creation of coax networking, followed by advances in the 'Cable TV'/CATV industry during the last three decades.

Satellite development was driven first by the need for telephone networking, then by the phenomenal growth of Cable TV in Europe and North America. Ultimately, while satellites continue today to carry significant amounts of telephone traffic, television programming is the fuel that keeps the satellite industry healthy, growing, and running at capacity worldwide. Fibre optics has become the darling of the telephone companies.

Conversely, fibre optics to date has been driven by cost savings and by the 'promise' of computer to computer linking. The real potential of fibre optics is its amazing bandwidth which we diagram on page 7. For the first time in the history of telephone communications, the interconnecting networks have far more bandwidth available than is put to use even at peak times.

THE CONVERGENCE ZONE

Almost nobody saw 'digital compression' coming; nor, the ways it would change the entire world of communications.

Digital compression (see CTD for 01 August 1993) in its original conceptual form seemed to be leaping from the pages of an Arthur C. Clarke novel. Complex, high data rate streams of information could be 'compressed' in time, almost in violation of Albert Einstein.

The abilities of computers makes digital compression practical. Virtually any data can be compressed, in time and space, into 'bit language' which shrinks its true size to an abbreviated format. The computer at the sending end reduces the data to its 'bit' practical minimum utilising algorithms (a mathematical process); a 'computer' at the receiving end uses the same algorithms to reexpand the shortened data to its original size. The art of 'compression' (how much the original material can be reduced for transmission) is today an immature science and its continued development will pace the advances in all communications over at least the next decade. Clarke again: "(for) *the end is not yet in sight.*"

WHAT IS FIBRE OPTICS?

A piece of fibre optic (cable, although cable seems strangely misused here) is not very impressive. Remember the glass straws you used as a child? Now add a (small) degree of flexibility and you have a length of fibre optic marvel; the byproduct of fusing sand with soda and lime under a carefully controlled environment.

ANATOMY OF FIBRE-OPTIC TRANSMISSION SYSTEMS

Light wave energy is 'modulated' at the source with a band of 'radio' frequencies; in analogue terms, up to 144 megahertz bandwidth can be carried in a single fibre. That's enough for 20 TV channels. Most systems operate around an infrared light wavelength of **1310 nm** (nanometre; one nm is one-thousand-millionth of a metre) although 1550 nm is also utilised. The modulation can be AM (amplitude), FM (frequency) or digital. AM is most common for TV because it can be converted from radio frequencies to infrared light and back to radio frequencies and be instantly compatible with standard TV receivers. Maximum fibre transmission lengths (before costly amplification is required) are 15km (AM), 40km (FM) and 50km (digital). The science of in-line light (repeater) amplifiers is very cutting edge; optical amplifiers using 130-280 mW (milliwatt) laser 'pumps' and fluoride fibre doped with the rare earth element praseodymium (Pr) have achieved 'gains' of between 15 and 28 dB (5 to 14X gain). In a system, multiple-fibres are combined to provide greater bandwidth between two points. In theory, a single fibre strand offering approximately 540Mbits/s of compressed digital bandwidth between any two (fibre optic connected) points on earth could be configured using today's digital technology. In practice, duplex (simultaneous two-way) exchange is facilitated by using fibre 'A' in one direction, fibre 'B' for the opposite (return) connection. The same 540Mbits/s bandwidth could accommodate 4,500 separate 120Kbits/s circuits. A 'bundle' of fibre optic strands may number hundreds of such individual fibre 'highways'.

As far back as Marconi experimenters demonstrated that you could 'modulate' a beam of light; marry the light beam to intelligence such that the beam 'carries' the modulation information. This was distinctly different than using the light source and a moving window to alternately block and emit the light for (Naval) telegraphic purposes. Modulating the light beam is analogous to sending a radio carrier through coaxial cable; 'keying' the light source for 'visual telegraph' analogous to the landline Morse telegraph circuits.

Modulating the beam of light was a school-boy science project from the 30s onward. In the 50s and 60s, 'laser' light technology provided a venue to update the science trick. The school science class project became more sophisticated; rather than modulating the light beam with a single data stream (or voice), techniques were developed to couple an entire range of frequencies into the laser beam; multiple channel data or voices (multiplexed) on a single laser beam, each of which could be 'tuned-in' much in the same way separate radio frequency carriers are sent through coaxial cable, and individually 'tuned in' along the transmission path.

Laser-links (short range point to point telecommunication links) were manufactured and sold in the 60s and 70s; you can still purchase them today. Their advantages: no licensing requirement, quick to set up and use. Their disadvantages: totally dependent upon line-of-sight transmission (cannot go through or around buildings), adversely affected by atmospheric variations (rain or heavy fog), and they never reached volume production. They are expensive.

But their modulation technology was instructive; a platform upon which modern fibre optic transmission networks could build. If a beam of light could be made to transport multiple separate radio (and TV) 'channels', how might one overcome the short range problems inherent with atmospheric transmission?

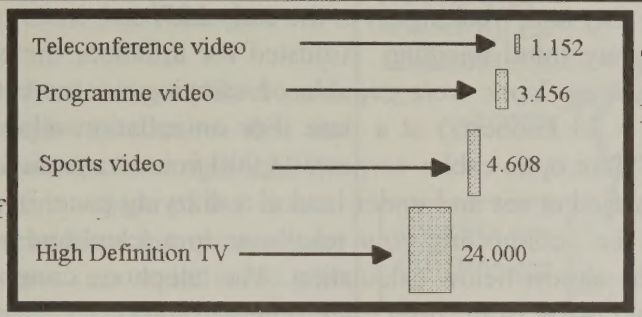
REFINEMENT OF AN ART

Initially short pieces of fibre optics were sold as a novelty item. Light fixtures bundled multiple tubes of fibre optic material into decorative arrays and these demonstrated that light could be introduced ('transmitted') into one end and then some distance away the same quality and almost the same quantity of light could be extracted ('received'). There followed at Bell Labs, USA's Corning and other small R and D facilities, a slow, gradual process of improving the light transmission capabilities of the fibre optic 'bundles' (as they were first called thirty years ago). There were two important advances; the discovery that some light wavelengths were more efficiently transported than others, and, that some material mixes (starting with the basic sand + lime + soda) fused under highly controlled temperature and pressure create much higher quality fibres. There were milestones along the way; the first transmission to reach a 100 metre length, then 1 kilometre, then 10 kilometres and so on. Each new advance in distance brought new forecasts of the ultimate usefulness of fibre as a transmission system.

Along the way separate research refined the science of marrying discrete channels of data/voice/television into the light beam source; modulation. And there were milestones here as well; first a single voice channel, later hundreds were possible. Then a single TV channel, followed by tens of TV channels. As the fibre researchers improved the transmission quality of the glass tubes and created clever ways to bundle or package the fibres into field manageable reels, the modulation experts were ever increasing the information bandwidth carrying ability of the modulated light source. By the early 1970s it was calculated the technology had reached the point where a single bundle of fibre optics cables to be installed between New York City and Washington (DC) would be capable of carrying all of the telephone calls, all of the data circuits, all of the radio signals and all of the television programmes in use between the two points. One

BANDWIDTH FOR SALE - ANATOMY OF A SINGLE FIBRE STRAND

The box (to right) represents the bandwidth capacity of a **single** strand of modern fibre using today's digital compression abilities. Each type of video is 'scaled' showing the actual 'space' it would occupy on the strand (numbers to the right of each are Mbits/second). For comparison, 345 POTS voice circuits occupy the space of the smallest shown here; teleconference video.



bundle of 'fibre cables' less than 5cm in diameter would replace dozens of coaxial cables and tens of microwave links. The future had arrived.

SELL COPPER FUTURES SHORT?

No area of telecommunications was harder impacted than the telephone companies. With tens of millions of kilometres of copper-based wire cables strung about the globe, fibre optics was either going to bury traditional telephone companies or create a profound change in the way they operated. Wisely, they chose to make fibre their own rather than leaving it in the open marketplace for competitors to exploit.

POTS (*plain old telephone systems*) have always been bandwidth limited. From the 1920s system designers had accepted the limitations of one, two and three wire telephone circuits. Starting with the inability of the POTS wires to transport more than a very narrow bandwidth of information, every other element in the POTS plant had been designed around this limitation. Each switch, each PBX, each amplifier ... even the plugs and jacks were designed to POTS standards. And that standard called for the ability of the system to pass or transmit a relatively limited bandwidth; the equivalent of 'average' human speech.

Numbers tend to be confusing, but try to grasp this set. The bandwidth of any signal is measured in kilohertz. There are 1,000 kilohertz in one megahertz. A human voice occupies approximately 8 kilohertz of bandwidth and this can be electronically altered to around 3 kilohertz without marked loss of intelligibility. Most telephone circuits allocate a 'bandwidth space' of approximately 3.3 kilohertz for your voice to pass from the microphone element in your telephone handset through the POTS to the speaker element in the other party's handset. Thus in 1,000 kilohertz (one megahertz) 1,000 divided by 3.3 or 303 separate telephone conversations can take place.

Now a comparison. A PAL television programme requires approximately 5.5 megahertz bandwidth. Therefore, Paul Homes coming into your home requires the 'spectrum space' (bandwidth) of 303 times 5.5 or 1666(.5) telephone conversations.

If POTS has designed to function with a single voice bandwidth (3.3 kilohertz) and you wished to send the Paul Holmes television programme through it, you'd have 1/1666th of the bandwidth needed. We'll return to that number since Telecom (and other telephone companies worldwide) are promising to send you Paul Holmes (and much more) through your POTS telephone line.

Returning now to fibre optic systems; today's technology allows as much as 1,000 megahertz of bandwidth. That's MEGAhertz, not kilohertz. This means the system could bundle together 303 voice transmissions (per megahertz) times 1,000 (the bandwidth of the fibre optic cable), or, 303,000 separate voice circuits into a single fibre optic circuit. This is the sort of number which

prompted a single 5cm diameter bundle of fibre optics to replace all of the coaxial and microwave links between New York City and Washington in the early 1970s.

The economics of this are mind boggling. Adjusted for inflation, the early transatlantic cables connecting London with New York were capable of carrying no more than ten separate voice transmissions (3.3 x 10 = 33 kilohertz) at a time. For an inflation adjusted similar expenditure today, a single bundle of fibre optic cables carries 303,000 voice transmissions. With globe circling fibre optic cables being buried at sea and under land at a dizzying pace, one can quickly appreciate how the cost per circuit (i.e., connecting your telephone to a telephone in London) will one day shortly be so low as to be almost below calculation. The telephone companies of the world have stumbled into a pot of gold made from fused sand, lime and soda.

And television? Well, before digital compression entered the picture, if you had a section of 1,000 megahertz bandwidth fibre optic cable passing down your street (as 600 homes in Auckland's Pakuranga and New Lynn suburbs now do), the telephone company could connect your home to 181(.82) separate analogue Paul Holmes; simultaneously. As overwhelming as 181 replications of Paul Holmes might be, as readers of our '*Digital TV Status Report*' (CTD 9308; 01 August) now understand, the digital compression of TV programming is a new technology. However, even today when digital is far from reaching its full potential, we can fit no fewer than 8 separate Paul Holmes shows into the bandwidth space of a single Paul Holmes in analogue format (5.5 megahertz). SO ... numbers again.

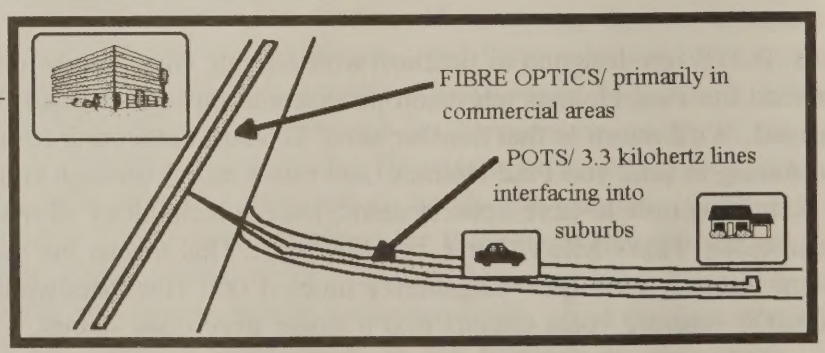
A 1,000 megahertz bandwidth fibre optic plant could carry 181+ separate TV programmes in analogue format, or, 8 times 181.82 ... 1,455 separate digital TV programme channels. Simultaneously. And that's today. As digital compression matures, the number only gets larger.

THE LAST KILOMETRE

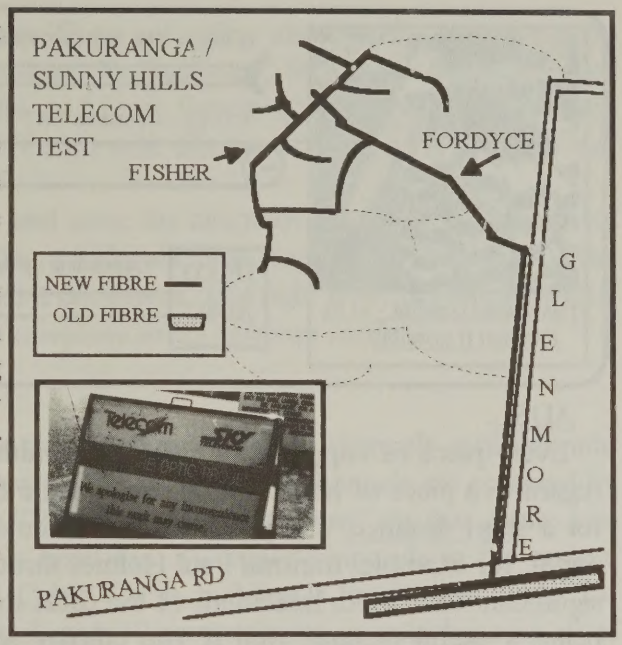
Under the New Zealand Post Office, our POTS was much like others in the middle world; lots of copper wires, mostly strung overhead on rotting wooden poles suspended from aging glass insulators. When the government decision to modernise the POTS was made, fibre optics was a promising if uncertain technology. The new government owned SOE Telecom elected to replace aging coaxial cable inter and intra city trunking systems with fibre optics, placing the new plant mostly underground. At the same time a decision had to be made about the individual copper lines running from town and regional exchange offices to individual homes and businesses. It was one decision level to replace trunking (main) cables with fibre optics; quite another to replace individual subscriber circuit lines with fibre optics. There was a point where an intermediate decision might have been made`; the subscriber circuits could have been replaced with coaxial cable.

THE LAST KILOMETRE

Fibre optic runs have been concentrated where high volume/ high bandwidth demands are located. Suburban and rural areas are still POTS; the upgrade to fibre can only occur if volume (revenue) follows.



Which brings us to the so-called 'last mile' (last kilometre) albatross of present day Telecom.



To connect your home to a fibre optic communications super highway requires that the wide bandwidth fibre product come right into the house; or at least to the curb outside of the home. All over the world, as telephone companies have replaced main (trunk) wires or coaxial cable with fibre optics they have been faced with interfacing this super bandwidth communications highway with the remnants of POTS; those two (or three or four) old fashioned small diameter copper wires that actually connect your home to the highway.

Throughout the world, as in New Zealand, fibre optic super highways have been laid between telephone exchange offices (switching centres), and into neighborhoods along main thoroughfares. Once into the neighborhood (such as the Sunny Hills section of Pakuranga), POTS interfaces with fibre optics.

The last (mile) kilometre, the subscriber lines that connect each home in the neighborhood into the fibre super highway, are POTS; plain old telephone (copper). In the instance of the Pakuranga 'fibre optic test', the super highway was already in place along Pakuranga Road (highway 5); thence north along Glenmore Road through Sunny Hills. The test area selected, reaching from Glenmore Road via Fordyce (Road), was POTS. The test involves replacing the plain old telephone system down Fordyce (and thence along adjoining streets) with fibre optic plant. This conversion is called 'broadband telephone service' (BTS) and when this step is complete worldwide, the telephone companies of the world may be unbeatable.

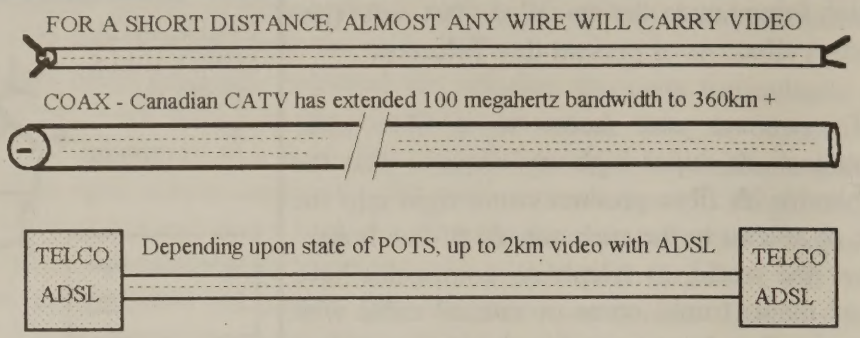
Virtually every telephone company, everywhere, faces this problem, known within the trade as "*the last mile problem*".

IS DIGITAL COMPRESSION THE ANSWER?

As noted, digital compression holds out the promise that more information can be transmitted within a given bandwidth. How much more (i.e., how much compression can be tolerated) remains unknown. As CTD for August 01 reported, full motion video (FMV) can be compressed so that up to 8 separate TV programmes can occupy the bandwidth now taken by a single analogue TV programme. That's good, but hardly good enough.

1/1666th. Remember that number? The POTS plant has the bandwidth of 1/1666th of a PAL format TV programme (with sound). Digital compressing by 8 gives us a PAL TV programme that occupies 1/8th the bandwidth of an analogue signal. To allow Paul Holmes to flow through POTS in glorious full motion colour demands further digital compression to around 200 times the present compression. That could be pushing the physical laws of science beyond the breaking point. Almost nobody in any laboratory anyplace in the world is optimistic about the chances of doing this. Telecom hopes they are wrong, the telecoms of the world desperately would like to avoid digging up sidewalks, driveways and streets all around the globe to replace "the last mile" of POTS with fibre optics.

Pakuranga conduit - to be avoided if possible



ADSL.

Every piece of copper wire has a bandwidth limitation; coaxial copper cable is superior in this regard to a piece of house wiring cable or the fabled 'twisted pair' of the telephone company. But, for a short distance, it is possible to send almost any bandwidth through any piece of wire. You might, for example, transmit Paul Holmes through 100 metres of household lamp cable before the significant bandwidth limitations of the cable lowered the picture quality to the point of no longer being a useful picture. And if you employ some special electronic circuits, along with today's state-of-digital compression, researchers at Bell Labs have demonstrated that a Paul Holmes likeness can be transmitted through POTS for perhaps 1.6-2 kilometres. The box that does this amazing feat is built around a technology known as ADSL (Asynchronous Digital Subscriber Line). In computer language, ADSL can process 1.5Mbits/second which is borderline adequate to allow a modest-motion TV show such as Paul Holmes to run through a short (2km or less) section of POTS. A new generation ADSL (ADSL-2 or HDSL) promises to process up to 6Mbits/second through a section of POTS (a sporting event such as Rugby with fast motion requires typically 4.6Mbits/second processing speed); field trials of the new (faster) version ADSL are just starting in New Jersey and New York.

Various telephone industry press releases during the past year have touted their new found 'ability' to transmit movies and TV programmes through your telephone line. Unless the telephone company is ready, willing and able to plug your phone directly into the nearest fibre optic trunk, this has to be ADSL family technology. What the press hype does not explain is:

1) In the best case, your home could be 2 kilometres from the nearest fibre optic line-fed LEC (local exchange); anything further and you are out of luck.

2) That local exchange must be connected to a 'switching system' that is fed by one or more television programming sources.

3) The telephone company must be willing and able to connect your home to this service.

4) The telephone company must be willing and able to place an ADSL encoder/converter 'on your line' at the nearest exchange office because the TV programmes you order must be ADSL 'converted' at the exchange before they are sent to you; and,

5) The telephone company must place an ADSL decoder in your home, connecting your telephone line to your TV set (yes, you could still make phone calls while Paul Holmes is coming into your TV).

At today's prices, the ADSL encoder connected just to your line at the local exchange will cost upwards of NZ$4,000; the ADSL decoder in your home will cost another NZ$1,000. And you have to be willing to pay for *all* of this plus the TV programmes you order.

Inspite of these limitations, some U.S. telephone firms are going ahead with ADSL 'TV by phone wire' tests at this time; they call it Video Dialtone. In Rochester, New York 100 homes are testing 'video on demand' via fibre optics and POTS. In Morris County (New Jersey) Bell Atlantic is rewiring an entire community about the size of Taupo with fibre optics and parts of it will test Video Dialtone.

ADSL is one of several promising technologies; and since the alternative is to dig up millions of miles of lawns, streets, and sidewalks all over the world (ala New Lynn and Pakuranga), the telecoms of the world have their fingers crossed that it does work. But right now, September 1993, it is not a viable commercial technology; *telephone company press releases aside.*

WHERE'S THE SWITCH?

Picture your standard TV set and your remote control. You have 2-7 channels available into your home, depending upon where you live in New Zealand. All of the channels are received by your aerial, and fed down a cable to your TV/VCR. All are 'in your house' on that cable; you select which programme you wish at any point in time; the TV 'tuner' responds to the remote control command. At Paraparaumu where Kiwi Cable TV is building a 'traditional' cable TV system, the viewer has complete independent control over 12 programming choices because all of the channels come into the home on the single coaxial cable.

With ADSL, only one TV channel will fit into the ADSL modified bandwidth of POTS. This complicates you switching from channel to channel (programme to programme) with your remote control because there is only one programme there to begin with. Video Dialtone proposes to locate the real switch back at the nearby telephone company exchange. A quantity of separate TV programmes would exist there; off-air channels, satellite delivered channels, fibre optic 'network' delivered channels, and hundreds of movies on CD-i (Video CD) discs. How does the customer 'sample' these TV programme sources before making a viewing selection?

With the capacity limited to sending only one programme at a time to the home, this is a bothersome problem for telephone companies trying to work around and through POTS. One experimental answer involves another acronym called ATM (not related to the automatic teller machine your bank operates). Asynchronous Transfer Mode is a light speed switching technique. Into ATM plugs every video programme source the telephone company has available. In its present prototype form, up to 2,500 homes could each individually call on ATM to make a programme switching function at the same time. The subscriber would, it is assumed but no hardware to do this yet exists, have a remote control which interfaces with the ADSL-like decoder box on his TV set. By pushing remote buttons, the ADSL decoder sends a command backwards through POTS/fibre optic lines to the LEC (local exchange centre). Here the lightning fast ATM responds to the in-home remote commands and sends back down the line to the specific home a rolling glimpse of each of the programmes of interest to the viewer. The

SKY AND PROGRAMMING

SKY's *John Fellett* tells **CTD** his firm (which shares a common ownership with Telecom through Bell Atlantic and Ameritech's 14.5% investments in SKY) will place 9 channels on the test-cable TV service. They are TVs 1, 2, 3 and TAB plus SKY's sports (ESPN + other services), news (CNN + other services) and movies. Two cable-only channels will be added: *CNN-direct* (SKY takes only a portion of the CNN broadcast day) and *ESPN-direct* (again, only a portion of the programmes received are used on the normal sports channel). They also plan to break-down the movie channel service into a weekly (and perhaps 24 hour only) offering giving the customer the option of taking just a portion of the month, 'on order/demand', rather than a full month at a time.

ATM is not cheap; the basic 'switch' sells for upwards of NZ$360,000 but it is useless without programming software and interfaces. Total ATM investment? Upwards of NZ$3,500,000 per location. The telephone company will have to 'sell' alot of TV programming to pay for one of these beauties. And if you need an ATM for every 2,500-10,000 homes ... well, in perspective the NZ$2,000,000 TV3 is reported to be spending this year to reach 208,000 new TV viewers is minuscule by comparison.

Several problems arise with ATM/ADSL technology. As long as only one TV programme can be 'crammed' into the POTS link of the system, each home must be limited to a single TV programme choice at a time. You might have two or more TV sets; but if you have only a single telephone line into the home, you will receive a maximum of a single TV programme via that line. That's all it can carry (although it would still allow your telephone calls through simultaneous to the TV programme). This may seem only a minor irritant to a home that now has two or three TV channels to select from; when the true broadband ability of fibre is realised, even in New Zealand there will be hundreds of programme choices possible. Any technology that restricts subscriber access will inhibit the system of course. This is another reason why, press releases hyping the telephone company aside, ADSL based 'TV via your telephone line' does not presently seem like a serious marketplace contender.

Another more popular approach is being followed in Telecom's Pakuranga and New Lynn test sites. Telecom is following the lead of America's cable giants by installing fibre optic cable 'to the curb (kerb)' of the home. Here's the concept.

1) Housing areas are broken down into units containing between 200 and 500 living units (New Lynn and Pakuranga with 300 each are within this range).

2) Each unit is called a 'node' and each node has what amounts to a 'substation'; the substation is fibre connected to the LEC (local area exchange) and in the opposite direction, to 'curb-side' service boxes along each street.

3) Each home is typically within 300 metres of a curb-side service box. The fibre optic line terminates at this box, as far as the home is concerned. Inside of the box is a (fibre optics) light wave to RF (radio frequency) 'block converter' that turns the fibre optic nanometre wavelength modulated light waves into standard VHF (band I,II,III et al) TV signals, tunable on your TV set.

4) The light wave to RF converter has a small broadbanded amplifier that powers the now standard TV signals into a passive network of signal splitters. These TV signals go into the home via RG-6/U grades of coaxial cable and into Scientific-Atlanta set top converters.

FIBRE OPTIC 'PILOT' TEST - THE TELECOM MIND SET

Telecom's major US stockholders (Bell Atlantic and Ameritech with nearly 25% each) worry a great deal about surviving the next decade. They see US cable giant TCI investing NZ$3.6B in 250 US cities over the next 18 months to add 11,000km of fibre optic cable with 1,000 megahertz bandwidths; recognising that with this bandwidth in place, nobody will need 'POTS' anymore. Bell-Atlantic's Arthur J. Bushkin recently said "*The telephone industry is much like a duck; what you see above the water line is tranquil. But below the water, we are paddling furiously.*" Telecom's Jeff Carter brings the worry home to New Zealand. "*Telecom is ensuring its core businesses are protected from any newcomers who get established in cable television first.*" New Lynn (Kiwi-economic average) and Pakuranga (upper-economic Kiwi) are in three phases: **#1/** provide off-air TV channels; **#2/** in six months, add more programming including specific programmes on demand ("*viewer select*"); **#3/** in a year, add interactive (two-way) services including entertainment, information, transactions and communications. The 'Pilot' plants soon to be turned on use fibre to the curb (16 homes per curb box), coax into the home with fibre optic AM (modulation) ending in Scientific-Atlanta set-top converters for subscribers.

In this format all of the TV signals (9 initially in the case of the Telecom experiment) go into the home simultaneously. Multiple TV sets in the home have multiple TV programme choices, just as if the signals were coming in via a TV aerial line.

The variations of this number in the dozens; far too many to detail here. Suffice to say that while it is possible to place fibre directly into each home, not even Bell Atlantic in New Jersey (with its highly controversial fibre to 'home' tests) is risking this sort of approach. In virtually every case, fibre goes no further than the curb where 4 to 16 separate homes share interfacing equipment. The technology to interconnect individual homes, by whatever format, is still very much an unknown and plenty of advanced stage system plans still have wall mounted plant drawings showing a small blank box that says "Interface Unit"; nobody is yet certain what piece of hardware actually goes inside of this box.

WHO PAYS FOR ALL OF THIS?

This is the $64B question. In the United States and Britain there are high level battles underway pitting the POTS against the newer cable TV firms. Cable pioneered broadband technology and they have an advantage; from the curb into the home they already have coaxial cable installed. With 55,000,000 US and 460,000 UK cable homes, this is a not insignificant advantage since the coaxial cable in place can easily be adapted to handle even 1,000 megahertz bandwidths over the typically short distances from curb to TV set(s).

The telephone companies were first to install fibre optics, but as in New Zealand they concentrated on the heavy traffic (trunk) routes, gradually expanding into the feeder routes that serve neighborhoods. But the telephone companies (with 94,000,000 US and 21,000,000 UK homes) are faced with the problem of "*the last mile*".

Both industries have equal access to the newest digital compression technology. Telephone has an ever expanding global encircling network of high capacity fibre optic plant. Cable, however, has a strong lock on the satellite distribution channels, and even stronger control of the programming services which have driven cable TV to meteoric heights during the past decade.

Both cable and telephone seem to be focusing on premium programming 'on demand'; i.e., 'movies on demand' (MOD) as the primary cash cow to fund fibre optics to the home. With CD-i and other FMV disc technology now available, a library of several hundred, several thousand, tens of thousands of movies and special programmes can be stored and automatically selected by computer to be shown to any single in-home viewer at any time. *For a price.*

By 1997, New Zealand will have more than 90 satellite transponders available (capable of bringing in upwards of 700 separate TV programmes simultaneously) plus an undetermined amount of 'overseas' fibre optic bandwidth. By 1997 digital FMV and VCR machines will be backed up by thousands of recorded programme choices. *For a price.*

With satellite transponder costs coming down rapidly (as the next generation of satellites come on line; see CTD for 20 November 1993), with fibre optic networking time costs coming down, and with digital compression making it possible to send full motion video almost anyplace in the world for a few cents per minute ... well, it is not beyond reason to anticipate the future with some considerable optimism.

If this is a machine, it will be an *economic machine* driven by consumer demand for the multitude of services now rushing towards us. And that's the big unknown ... *how much money will people be willing to spend* to have their TV set turn into a multimedia 'video library of the world'?

TECHNOLOGY
BYTES

...BITS AND BYTES YOU MAY HAVE MISSED IN THE RUSH TO MAKE A BUCK...BITS A

SATELLITE TV

SKY CHANNEL, the Australian subsidiary of Channel Nine Television Network, is testing a package of Thoroughbred Racing on Intelsat I-V-F8 (180 east), transponder 22 (4.135 GHz) typically weekends. The SE Asia/Pacific/western USA service plans two meets per day, six days per week from metropolitan, provincial and country tracks. Tests have been in the clear; actual service will be encoded. Footprint is 29 dBw, translating to 3.5 metre or larger dishes virtually anyplace in New Zealand and they are looking for Kiwi customers. Pricing and details from Peter Hawkins (FAX) 0061 2975 4835 or 0061 2452 4540; (TEL) 0061 2451 0888.

JAPANESE tourists in your town? A two hour nightly (10-12PM NZ time) service from TV Oceania (Australia; owned by Japan Airlines and consortium of Australian investors) carried encrypted on OPTUS Ku band A3 satellite, transponder 7 (now located at 156 east) could be of interest. One hour NHK (Japanese national network) evening news followed by quiz shows, Japanese sitcom, documentaries is fed by subscription to Australian motels, hotels where tourists have push-button option of tuning in nightly transmissions from their rooms for a fee. Service is "as good as local TV" on 3.7 metre dish in Auckland area but there is confusion concerning TV Oceania willingness to authorise service outside of Australia. Robin Colquhoun (09-630-7127) reports considerable business interest in service from within NZ tourism facility world, but professes quandary how to sell it. In Australia, Oceania charges A$80 per month to private satellite terminals, considerably more to commercial installations. Firm also offers annual lease on installed dish system (electronics/antenna/decoder) for A$3,000. Encrypted security is VideoCrypt, same 'smart-card' system utilised by SKY TV in New Zealand.

TONGASAT vs. PT PASIFIK; not a Japanese sci-fi thriller, but a battle in the skies none the less. In August 1992 a private Indonesian firm (PT Pasifik Satellit Nusantara) acquired aging Indonesian government Palapa-B satellite. A market in 'used' satellites has developed in recent years. Satellites retired because they no longer can maintain exact over-equator positioning are either 'bumped' into outer space, or, operated at reduced capacity in figure 8 'inclined orbit' mode. Under private ownership, the older Palapa B might provide low-cost communications for an additional 3-4 years (through 1996) if operated as inclined orbit bird. The new owners moved it away from functional 117.9 east position and 'temporarily' parked it in looping orbit between 135 and 145 east; more recently it settled near 133.9 east and announced it was 'in business'. In July of this year Tongasat which holds six internationally registered orbit positions (including 134 east) authorised space-leaser RIMSAT to move its Russian built Raduga satellite to 134 east. The Indonesians claim RIMSAT is an intruder pointing at its own 'request' for 134 east filed in 1992. Tongasat responds PT PASIFIK lacks international registration approval to be at 134 east and believes Indonesian request for 134 was never acted upon by ITU because Tongasat had previous permission to be there. Both satellites operate in the same frequency range (3.7-4.2 GHz), each has southeast Asia footprint capabilities and both operate in inclined-orbit mode. This problem has not arisen previously in the satellite world and legal options open to the parties are unclear.

NINE NETWORK/Australia reported to have reserved 'options' on ten 'C band' transponders on Asiasat 2 satellite scheduled for launch to 100.5 east during 1994. This satellite plans 34 dBw footprint over portions of New Zealand (along western coast of North Island, most of South Island) but look angle is very low (5-8 degrees above horizon). Normally a 34 dBw footprint would translate to 2 to 3 metre size dishes but at this look angle so close to the western horizon, earth noise will require larger antennas (4-5 metres) be used.

ASIASAT 1 C band satellite at 105.5 degrees east (with no footprint coverage into New Zealand) has expanded temporarily onto Comstar D4 satellite purchased by China National Postal and Telecommunications Appliances Corporation (CNPTAC) from AT&T and moved to 100.5 east where it will operate as a 'bridge' until Asiasat 2 begins

IN (next issue) CTD for 20 November: An extensive review of the present and near-term future world of satellite TV service available to New Zealand; the gateway to the world opens in 1994.

operation early in 1995. Comstar D4 footprint from 100.5 east is all north and of no practical value in southern hemisphere.

SATELLITE TV ASIA '93 is first-ever Pacific region trade show directed at fast developing home and commercial dish industry; scheduled October 27-29 at Kata Beach Resort, Phuket, Thailand. Conference organised by Mark Long, world publisher of satellite TV manuals and reference books will feature wide range of speakers including co-hosts Star TV which operates multiple programme channels from Asiasat-1 satellite; trade show exhibitors from throughout world. Meeting will include three days of intensive training seminars for those just entering or already into field. Full details from Mark Long, MLE INC. in Florida (TEL: 001-305-767-4687; FAX 001-305-767-6067).

STAR-TV, the multi-channel entertainment/sports/news programmer using the bulk of Asiasat-1 transponders, now claims 45 million viewers spread from Turkey to Japan, the Asian Arctic south to Indonesia. Recently Rupert Murdoch News Corporation acquired 63.6% of STAR's Hutchvision operating company based in Hong Kong; a move that has drawn flack from a number of Asian governments who apparently fear his operating record in the media world. Star combines 'open transponders ' (not scrambled) with scrambled (fee each month) services to reach an estimated 11 million Asian homes, a format that has driven the home satellite industry in Europe to more than 120 different video service channels and produced a booming home satellite industry there. STAR is reported to be targeting massive publicity push across India and is sponsoring a self-help book in several Indian languages to assist people there to install their own home or community dish systems.

DirecTv direct to home service scheduled to offer up to 150 Ku band TV channels to dishes .45M (or smaller) in size across North American continent mid-94 is readying US$50-60 million advertising campaign to promote sale of Thomson Consumer Products manufactured US$700 home satellite terminals. DirecTv is owned by Hughes/General Motors and RCA/General Electric.

TEMPO, subsidiary of cable giant TCI, has placed NZ$740M order with Loral to deliver 'in orbit' pair of high power (200w) 32 transponder Ku band satellites in June and October 1996. TCI plans to compete with DirecTv, USSB. With 64 transponders, birds could deliver more than 500 digital TV channels direct to homes equipped with dishes as small as .25m in North America.

PROFIT for satellite TV programmers has been slow in coming, even in Europe. News Corporation BSkyB service reports weekly net profits averaging NZ$5.1 million on weekly gross of NZ$21 million (24.3%) with just under 2 million subscribers to film channels, 1.7 million subscribers to sports channel. Overall BSkyB revenues grew 60% to financial year end June 30.

HBO ASIA is now being distributed in Philippines primarily through 'wireless cable' microwave services. Five Asian region DTH (direct to home) satellite programmers have formed consortium to coordinate change over from analogue/encryypted transmissions to digital/compressed transmissions. HBO Asia with Turner (CNN), ESPN, TVB International of Hong Kong and Australia's ABC all hold transponder leases on Indonesian Palapa B2P and plan to lease space as well on new APSTAR-1 satellite scheduled for mid-94 deployment with service to SE Asia.

RUSSIAN satellites may dominate skies within a decade but users will be non-Russian according to recent analysis of satellite costs versus returns. Russian launch technology developed faster during 80s than western nations, and while Russian satellite designs remain 'basic' there are many potential users who see far lower lease-operating costs as good tradeoff. Russia has signed deal to provide three new broadcasting satellites which are scheduled to be in operation before end of March 1994; one of these is described as 'Pacific bird' but exact operating plans are unknown. New series have phased steerable beam up and downlinks with potent footprints of +30 (3.0 metre dish) to +50 (0.5 metre dish) dBw. In separate deal, a Russian Express class satellite with 10 C band (3.7-4.2 GHz) and 2 Ku band transponders has been leased by Intelsat for 'Pacific Region' service; scheduled operations date mid-94. Intelsat had previously planned replacement of bird 510 (174 east) 'early-94' and bird 511 (177 east) in mid-94.

UK sales of home satellite dishes may be slowing down; approximately 6% of all UK households now have dishes. Predictions are that 12-13% will have satellite TV by 2,000; projecting 4.5 million dish systems. BSkyB was scheduled to begin encryption of most of its 14 TV service channels on 1 September, a move many in industry believed would further slow the pace of home dish growth in the UK.

Standard Communications (P.O. Box 92151, Los Angeles, Ca. 90009: FAX 001-312-532-0397) has new world-class 'does everything' satellite communications receiver. The "Intercontinental" covers full C and Ku bands (with appropriate LNB), broadcast spec performance for NTSC, PAL, SECAM format signals with universal power supply, PLL frequency agile dual channel audio demodulators with 1 kHz dial-up steps plus 5 selectable bandpass filter widths (880, 440, 330, 150 and 75 kHz). Six audio de-emphasis circuits (including 50, 75 ms, J-17, flat and companded) are included; with front panel metering for C/N, signal level and tuning.

DIGITAL TV

DIGITAL TV CHASSIS making greater use of digital signal processing has appeared in Panasonic sets using TX25W3 and TX28W3 chassis designs. Already sold in Europe as a part of the 'EURO-1' line, these chassis represent major swing towards digital benefits. Past attempts at making some of the video signal processing segments digital had been disappointing. Initial European reports suggest Panasonic has cured most of these ills. Heart of chassis is Matsushita developed DFU (digital features unit) employing 8-bit resolution for both luminance and chrominance signals and 14-bit resolution for audio processing. Sales people will find AI (artificial intelligence) feature excellent for demonstrating set's picture capabilities. Feature has three positions (on, dynamic and off) with dynamic intended for demonstrations. AI continuously monitors maximum, minimum, average video signal levels over thousands of individual pixel points. Averaging what it measures, AI improves display definition on overly dark (or light) scenes by maintaining average luminance levels across dark or bright spots and expanding levels at transition points in picture. Models also use new digital chroma transient improver, digital comb filter and digital luminance transient improver all of which are reported to be especially effective where signal is noise polluted. Panasonic model numbers in New Zealand not known although recently released Mitsubishi branded Diva Black Diamond 29" CTV AC1 set (available at Appliance Court stores) claims "Fuzzy logic A.I. picture system for the optimum picture".

BRITISH ITC has released report recommending ten year transition period from present analogue to new digital TV broadcasting standard. ITC suggests allowing present telecasters to transmit simulcast (parallel) digital standard transmissions from an early date, then allow new digital-only services to fill remainder of spectrum space available. A national study for proposed (British) channel 5 service is now on hold awaiting decisions on digital implementation. Report suggests most Britons could have twenty new (digital) TV channels with plan; but recommends actual transition start await formal adoption of European-wide digital TV policy.

EUROPEAN Launching Group (ELG) for digital video broadcasting expects to reach agreement for all-Europe digital TV standard by 1 January (1994) with commercial digital TV transmissions available before end of 1995.

EUROPEAN COMMUNITY has finalised details on NZ$540 million programme to speed up implementation of widescreen (16:9) TV broadcasting. Fund was originally proposed as seed money to be granted on a matching fund basis to telecasters and programme providers to assist them in equipping their systems for widescreen standard. Project origins precede recent meteoric rise of digital TV as 'next plateau' of telecasting and how digital-fever sweeping Europe will impact the project is not known. Europeans adopted 16:9 PALPlus format in 1991 with letterbox display on conventional 4:3 receivers.

AMERICAN 'paper' standards for HDTV are expected before March 1994; one likely scenario suggests 787.5 lines and 60 fields per second with progressive scanning. However, there is also sentiment for interlaced scanning as well. If both formats survive tests, scenario suggests all HDTVs will be 'multiformat' and that cuts deeply into future designs of VCRs, TVs, even camcorders. Studies to date indicate progressive is more expensive (7%), multiformat progressive (720 line) and interlaced (960 line) are more expensive again (another 7%). Europeans seem to be awaiting results of US decision which hinges on field trials (June-August 1994) and final reports (October 1994).

EIGHT major Japanese and two prime European manufacturers of VCRs have reached pre-digital-production accord on establishing uniform 'world VCR standards' for new generation of digital VCR units. Citing the original BETA-VHS battle, and the more recent ongoing VHS vs. 8mm standards competition, Europe's Philips and Thomson plus Japan's Hitachi, JVC, Matsushita , Mitsubishi, Sanyo, Sharp, Sony and Toshiba have 'agreed to agree' on a single worldwide VCR format. The basic digital format agreement will also include a common approach to recording widescreen and high definition TV as the various world bodies come to their individual decisions on these two related technologies. The agreement covers the basics: a mechanical system using metal evaporated (or equivalent) tape 6.25mm in width and a slant-azimuth format; playing time 4.5 hours for a standard cassette, 1 hour for a smaller package (i.e., camcorder) package. The audio will be PCM format, four channels, digital stereo. The data rate will be 25Mbits/second and with HDTV the tape speed will double and the data rate goes to 50 Mbits/sec. Because there will still be some analogue TV material around when the digital recorders hit the market (1995?), PAL, NTSC and SECAM will be converted to digital form using the basic MPEG standard in a way similar to the CD-i discs. For comparison, the latest professional 'D5 format' VCRs can record close to 300Mbits/s.

DIGITAL VCRs will not be without 'legal' problems. Analogue recordings have a built-in limit on dub generations because of cascading effects of undesirable noise and artifacts. A third or fourth generation VHS copy, for example, is seldom usable since each generation after the first adds degradation. Not so with digital recording. Virtually mirror-image dubs into the 50-100 generation region are typically practical with professional digital recorders which have been available to TV broadcasters and production firms for several years. In the hands of the public, digitally

recorded rental tapes for example could be copied and recopied and recopied (ad-infinitum) with no significant degradation. This creates instant copyright (i.e., copying is a violation) problems which VHS has skirted because of its own built-in limitations. A similar problem with DAT (digital audio tapes) held up the consumerisation of DAT (tapes) for nearly five years. Japanese and European VCR manufacturers say they will have an answer to this potential liability; somehow building into the recording head circuitry gates for command codes which if absent prevent the record heads from functioning. We've not heard then last word on this subject ...

DIGITAL VCRs will change the way movies and programming is packaged on sale/rental tapes. Although recording times up to 480 minutes are possible with analogue tapes in long playing modes, true 'VHS quality' recording time is generally limited to 240 minutes with E/T240 tapes. Present digital plan calls for 270 minutes of recording time on tape which will be approximately 50% the width of present VHS tapes.

JAPANESE have announced year 2015 goal of ultra definition TV that would have 4,000 line resolution. Research programme is backed by Japanese government funding on a shared basis with Japanese electronics firms.

CONSUMER ELECTRONICS

FLAT PANEL screens for television will be shipped by Matsushita in October; first ever for industry. New 14" flat panel display ("beam matrix") is 9.9cm deep, uses hybrid LCD/CRT technology. Video signals are transmitted to screen in same format as LCD displays but inside 9.9cm sandwich are nearly 10,000 'tiny' CRTs. Each CRT is fed its own beam and control signal. 'Flat Vision' is totally rectangular, has no stem or neck, uses phosphor screen like CRTs. Advantages include far greater brightness than LCD, uniform brightness, linearity and focus to edges of display. Disadvantages are it consumes more power and is thicker than LCD; and initially will be more expensive. Matsushita plans only 3,000 units per month at first, will sell for more than NZ$4,800 and only in Japan until late in '94. Firm believes screen sizes 10" and down will eventually be primarily LCD; 11-20" will be CFP (colour flat panel) and direct view over 20" will be CRTs for foreseeable future. Amongst first likely sets to reach New Zealand shores will be a combo 20" region screen and miniature VCR package that could hang on wall (18 kg weight).

PHILIPS in combination with Thomson and (French) SAGEM have a newly developed diode-based LCD active matrix display. Co-owned Flat Panel Display Company is being set up in former Philips memory chip facility in Holland. Diodes in place of transistors reduce costs, brighten display and draw less power. Applications go beyond TV and include computer screens and instrumentation.

Liquid Crystal Light Valve (LCLV) with low cost consumer display applications has been announced by Sarnoff (one time RCA) Labs in New Jersey. New LCD chip uses polysilicon with internal integrated drive assembly. Sharp, Sony and Seiko Epson have announced work on similar technology. Using digital design approach, new LCD avoids complex and expensive Japanese approach to LCD built around amorphous silicon. Latter requires high component count electronics to select, route and drive display voltages to individual pixel elements on flat (LCD) display screen.

Portable LCD video projector weighing under 1 kilogram from Sony could be good seller in educational/industrial marketplace. 152 x 102 x 64 mm package projects images to 100" width with 103,000 pixel resolution powered by 18 watt halogen from AC mains or battery; NZ$1400 range.

DCC (tape audio) vs. MiniDisc? Major battle ground presently involves auto manufacturers and their interest in making in-vehicle provisions for 'future music systems'. Philips had hoped DCC would be next auto-sound technology and was counting on Ford to back it. Ford says it was interested, but now believes MiniDisc is format with best likelihood of consumer success. Philips, Grundig, Panasonic and others displayed first DCC player equipment at German auto show late in August. Sony displayed Minidisc.

RENTAL tape piracy of movies and other material may be a more difficult task in New Zealand, shortly. Video Distributors/Road Show has signed agreement to utilise near-world-standard Macrovision AntiCopy Process of mastering tapes for distribution. Macrovision claims its encoding system can cut unauthorised duplications by 91%. MCA/Universal, FoxVideo, HBO and Buena Vista (Disney) currently Macro-encode all of their releases. Paramount, Warner and MGA/UA selectively encode with the system. Major distribuitors Orion and Columbia TriStar do not. By playing with sync and video levels, Macrovision system produces weak, washed out and usually rolling 'copies' when user tries to run a dub. Like most such systems, there is a 'black box' distributed in most countries using

system which restores sync and video levels to their original (VHS) purity. For every force, an equal and opposite reaction ...

DUMPING ANALOGUE TVs? Price-cutting New Zealand Warehouse chain has quietly been offering Singer (Chinese manufactured) 20" TVs for $599.95. What's so unusual? These sets, with remotes, are full multi-standard (model # 402IPS) with PAL/NTSC/SECAM including NTSC 3.58 and 4.43 MHz. At likely landed price of near NZ$365, these have to be the bargain package of the year. Import records show approximately 341 sets imported during July. Could it be Singer is worried they could get caught with analogue TV inventory when digital TV hits?

BBC-approved standards for videotape causing furor in UK. Little known BBC technical study of consumer videotape qualities with recommended parameters for 'acceptable tape' fell into hands of Korean firm Strand Ltd. which proceeded to create tape to these specs; claiming on cartons and in advertising it was "manufactured to BBC-approved standards". British Tape Industry Association claimed BBC was showing favoritism to supplier and investigation revealed BBC did indeed approve tape development and promotion, and is receiving 'financial return' from arrangement.

FERGUSON brand TVs, 80,000 in all, manufactured by Thomson and sold in UK have been recalled for defective power switch which reportedly turn set on without assistance, or overheat when turned on.

ROTATING colour wheel equipped with red, green and blue filters, turns viewfinder on some new camcorders into colour display. Wheel is rotated at 150 r.p.m. and RGB signals are fed to tube sequentially synchronised to wheel rotation. Similar system developed by American CBS network in late 1940s was initially approved, then discarded by US authorities as standard for broadcast colour TV.

8mm CAMCORDERS will shrink even more with development of one-chip ICs for standard and Hi8 format. Sony's new chip replaces three in present 8mm format packages and will reduce cost of camcorders by approximately NZ$40 at OEM level. A Sony Hi8 VCR deck with computer editing interface, AFM stereo, and Synchro Edit ability with bi-directional shuttle has also been introduced; under NZ$1200 for lowest Hi8 deck price to date.

CANON Hi8 model UCS5 camcorder has 16:9 widescreen recording capability using image-squeeze rather than letterbox format. New package also has 24X digital, 12X optical zoom, stereo audio and expected list price of NZ$3500.

HITACHI model VM-E53 is 0.73kg weight 8mm camcorder with fully automatic 'simplified operation' package with 1.5X optical and 16X digital zoom. Model reduces user buttons to 11 and parts count by 40% ; same chassis is NTSC and PAL design reducing construction-design costs. 25,000 units per month planned for export; NZ$1750 likely.

RECORD-only camcorder by Matsushita has climbed beyond 100,000 units sold; primarily in Japan. Unit is low end priced but so few leave Japan no world market price is established. They expect to ship 300,000th unit before product is one year old. Firm has also introduced 'HI-C' version of VHS-C camcorder; 400 line resolution with 580,000 pixel CCD including 250,000 around CCD perimeter for use with electronic image stabilisation (EIS) system. Unit has colour LCD viewfinder, 10X optical, 20X digital zoom. Pricing not yet announced.

8mm/VHS dual deck VCR being introduced this month in UK by Goldstar with suggested price in NZ$ of 1700. In VHS mode unit has 4 heads; in 8mm uses VCP. Unit apparently cannot be marketed worldwide because of patent conflicts.

WIDESCREEN combo TV/VCR from Sharp is likely to be first such package offered. Screen will be 22W (wide) which translates to height of standard 18" tube; Sharp already offering 26W and 30W widescreen receivers in Japanese market. Expected release of combo unit; December.

4:3/16:9 is subject of patent pending in Europe by Samsung. How to make next generation 16:9 widescreen TVs 'look good' when fed non-standard 4:3 aspect ratio video is crux of problem. Samsung explains approximately 6% of vertical direction scanning lines are selectively 'eliminated' (not in a group, but spread through picture). The horizontal direction is then 4/5ths compressed. Samsung claims "picture loss is minimized, screen expansion is within range that average viewer cannot perceive the corrections made". Assuming receivers are actually manufactured to this format, viewers will end up with less picture than before, although it will 'appear' to be bigger. You can fool some of the people some of the time ...

CD-i OR VIDEO CD? Philips and major partners Sony, JVC and Matsushita thought they had the interactive video (CD-i) market under control. Philips issued a 'White Book' for production standards this past March, offering to share the technology with the world. The plan was to adopt a single interactive video CD format to encourage software production. Everyone accepts that hardware is wonderful; *software drives sales*. Then along came small

BACKGROUNDER: CD-ROMs

Compact discs read only memory (CD-ROM) have been the mainstay of the recorded music industry for nearly a decade. CD-ROM players are built to a bit-format; there are 8, 16 and 32 bit versions. More bits is better in terms of speed and packing data into a finite space. Data can be formatted on the disc in an unlimited number of ways; the Philips (et al) CD-i is but one software approach. Others of note include (USA based) Radio Shack with VIS (Video Information System), Commodore's CD-TV, and 3DO. A compact disc can contain still photos, moving pictures, text, graphics, words, music or any combination of these. Discs recorded in one format cannot be played on players dedicated to an 'alien' format. Yes, there are some multiformat players but they are not yet common since formats come and go. Further complicating the user problem is the vast choice of programming. A 'CD player' plays music; that's simple enough. But if the disc impregnated bits carry pictures or a movie, the player must be compatible. Interactive CD games and now movies are the latest formats. Since all products carry the same basic '**CD**' nameplate, consumer confusion is a significant problem in the marketplace. If that isn't clear, wait until **Mini**discs hit New Zealand (very soon) with disc-recording abilities in the home!

British firm Nimbus Technology and Engineering with an almost identical "Red Book" format which they attempted to trademark as Video CD (they failed; the phrase is generic). "Almost identical..." but not the same. Nimbus had the audacity to point out an 'error' in the Philips "White Book"; the king was naked. Nimbus claims its system is compatible with ordinary (audio) CD players; and that the Philips (Sony, et al) system is not. Nimbus envisions a "MPEG video CD adapter" could plug into the digital audio output (accessory) socket on some players; around 30% of existing players, Philips estimates. The CD-i format uses an always-present-during-play 'header' or 'flag' that instructs the player on what format is in use. When the players see this 'XA flag' the audio output socket is disabled to prevent digital gobble-d-gook from trashing an expensive speaker/sound system by mistake. As long as the new generation CDs contain this XA flag, there is nothing at the audio/accessory socket to drive the external (Nimbus or other) MPEG video adapter. Nimbus suggested Philips correct this fault; Philips first said it might do so, then retracted its statement explaining this could cause user problems with older CD-i players already in the field. Philips believes approximatly 250,000 CD-i units, equipped to shut down any output appearing on accessory socket with the XA flag present, will be in operation worldwide by end of this year. Philips meanwhile is into production of a full-motion (FMV) 'cartridge' (European model number 22ER9141) that will plug into existing CD-i decks and allow the user to playback (FMV) CD movies. That's important because Philips and partners have signed an agreement with Hollywood's Paramount to release 50 FMV movies on CD-i discs; 35 titles are due out in the next six months, some are already 'pressed'. Philips is offering four categories of entertainment discs: adult entertainment, children's programmes, games and reference material. *Voyeur*, an erotic interactive movie is included in the early titles. Which brings us to one of the reasons why early test marketing in Japan has produced reported sales of 2.5 million discs since March. The 'i' stands for interactive in case that fact had slid by you. Interactive allows the viewer to stop the motion and 'become involved', making viewing choices, selecting camera angles, even deciding whether the damsel in distress escapes or is ravaged by the beast. If you elect 'ravage', then you have new interactive choices; such as how ravaged, and using what utensils. Not to miss this business opportunity, Samsung and Goldstar have signed on recently and Commodore through Amiga is launching CD32; a 32-bit CD ROM games system that thoughtfully leaves plug-in space for an MPEG module to allow Video CD playback. Costs? Well, MPEG based plug-in adaptor/decoders will likely be in the NZ$450 range, the Philips (et al) FMV cartridge around NZ$600 and (consumer) full Video CD players around NZ$1300; up. In the industrial field, Philips has CD-i350 with included LCD flip-out colour screen; Goldstar the GDI-11 which is intended primarily for karaoke in the NZ$1600 range; Sony the IVO-VII CD-i portable. The consumer is bound to be confused by the flood of often incompatible hardware and software and the very mess Philips wished to avoid with its 'White Book" standards exercise seems to have occurred in spite of their efforts. If you are a retailer, try to follow this: Video CD discs will play on a CD-i deck equipped with an MPEG decoder, but not all CD-i discs will play on a Video CD machine. Ordinary CD-i titles and CD-i discs which mix full-motion video with interactive programmes will not play on Video CD machines. Some CD players can process FMV discs to video through the accessory-out digital audio socket; more cannot. Some of those that cannot may be 'modified' by a skilled technician so they can, most cannot. It seems the Video CD field is itself interactive; OOP's there's an on screen prompt now. "How ravaged and using what utensil? List follows." Good luck explaining this to your retail customer.

Philips Media Electronic Publishing is newest software venture for firm. Previously, Philips Interactive Media International had been formed to support, fund creation of CD-i format products. This firm is replaced with PMEP

which has much broader mandate; to create software for wide range of TV and PC based systems of which CD-i is only one format.

3DO, format competitor to Philips CD-i, has signed Panasonic and Sanyo to camp. 3DO system uses MPEG decoder and is 32-bit system designed for interactive applications. AT&T, which bought interest in 3DO earlier this year, plans a 'networking version' of package in console form in 1994. Panasonic plans launch of R.E.A.L. interactive multiplayer in North America early in October with Masushita production capability of 30,000 per month; suggested US 'street price' of NZ$1260 with dealer margin near 28%. Panasonic plans FMV cartridge for CD movies in first quarter '94. 3DO claims more than 300 'software licenses' have been negotiated with would-be after market suppliers.

HITACHI features Dolby Pro-Logic Surround Sound with audio output power of 55W r.m.s. on two new models; (European numbers) C2574TN and C2874TN. UK pricing is between NZ$2550 and $2850.

AMERICAN AT&T hopes to offer NZ$1000 price range videophone by end of this year, using video compression technology not previously available.

JVC has announced Japan availability of new generation multimedia player; model RGM2. Using 68000 processor, unit plays CD-ROM computer games, Sega Mega Drive, karaoke CDs, audio CDs and CD plus graphic discs. Pricing equivalent to NZ$800.

Newest PIONEER Laser Karaoke models (3) range from NZ$1600-3800; feature digital stereo keyed to singer's voice, dual independent microphone level set, 20 selectable track selection keys, repeat function. Higher priced models also include ability to turn singer's voice into chorus and 'vocal partner' which substitutes user voice for prerecorded vocals.

NINTENDO pretax profits 1992 exceeded NZ$3 billion; greater than Microsoft (or IBM) and similar to Masushita. Firm did twice profit as Sony and latter had sales more than 6X Nintendo and staff 10X. Nintendo is bringing out next-generation game machine built around CD technology. Economists are pointing to tight marketing/promotion controls Nintendo insists upon, and lack of competitive pricing controls as primary reasons for company's recent growth. Firm recently closed out worldwide investigation of counterfeiting of game cartridges, largely appearing in Central and South America, tracing them to China factory through Hong Kong shipper. Nintendo is no johnny-come-lately; 100 years ago they began by producing playing cards.

NINTENDO and Japan Air Lines (JAL) are now offering custom designed 'JAL Mega Jet' version of Sega's 16 bit game console on JAL international flights. Six game selections are stored with 24 consoles on each flight; travelers may also bring their own games. In separate action, Nintendo has released 'Gateway System' for widescale application in airline, hotel and passenger liner fields. China Airlines, Virgin Atlantic, Northwest are amongst first to sign on. At Northwest, 16 planes are being modified at cost of NZ$7,200 per seat with installation of personalized multimedia systems. Through (Sharp manufactured) colour LCD screen mounted in seatbacks (coach) or tilt-arm (business and first class) and companion control panel passengers have access to 8 Nintendo games, selection of movies, shopping and information services. Each seat unit contains 2MB of RAM fed by central serving unit for games with typical charge of NZ$7 per hour of use.

CD capacity, expected to expand greatly with improved digital compression algorithms, could also benefit from recent Sony perfection of blue-green emission semiconductor laser. Present CD systems utilise red laser beam which has a definition ability of 0.78 micron. Blue-green laser is shorter wavelength (0.523 micron) translating to greater information packing on disc. A CD-i format video disc presently holds up to 72 minutes of compressed video/stereo sound. Sony believes new 5" CD discs will have information capacity 2.3 times as great utilising blue-green laser rather than red laser. Sony may not market blue-green technology laser products outside of industrial area, however. Firm believes real future is with yet-to-be-perfected blue-laser offering 460-500 nanometre resolution. Sony suggesting with blue lasers, long playing video on 2.5" MiniDiscs will be compatible with data retrieval systems. Time frame for blue-laser; five years.

PLATINUM CD-ROM? Filmmaker George Lucas (*Star Wars* et al) believes million-selling interactive CDs featuring video adventure built around the viewer making plot decisions will become common place before the end of this decade. Lucasfilm division has released *Indiana Jones and the Fate of Atlantis* in which viewer becomes participant making hundreds of choices concerning character moves, dialogue. Lucas says effect is to put viewer into position of making his/her own movie which he characterises as "a new form of storytelling".

APPLE Newton will have serious competition from Sharp, manufacturer of Newton for Apple, and "Zoomer" package from Casio/Tandy planned for October shipment, plus AT&T/EO product which includes cellular telephone. Apple now calling Newton 'Communications Assistant' and US selling price around NZ$1700 for unit plus peripheral communication tools.

JOHOSHAKAI. Add to your lexicon. Japanese for 'information society'.

YEN report. To US$, in spite of strengthening of Japanese yen, all major suppliers except Pioneer anticipate staying with 110 yen = US$1 through end of this calendar year. Pioneer expects to adjust to 100/107 range in hopes of higher profitability. Pioneer has recently been fighting profit squeeze; in fiscal quarter ending 30 June operating profits plummeted down by 74.2%. Firm blames modest softening of sales (-8.9% at home, -16.8% outside of Japan) for portion of drop; strong yen for most of its problems. Sony also reported disappointing 30 June fiscal quarter earnings; down 35.8% against +16.1% increase in US sales in dollar measurement. Worldwide, consolidated Sony sales were down more than 9% in same quarter with camcorder sales hardest hit.

CABLE TELEVISION

GREYMOUTH/correction to CTD 9308 report. We reported Civic Enterprises backed PacSat application to serve neighborhood regions of Greymouth with miniature (8-20 home) cable systems fed via microwave would utilise 2.1 GHz region frequencies for through-air distribution. We were in error. Firm's John Rutherford advises he has secured Ministry of Commerce permission to utilise 12.750-13.250 GHz region for up to 8 TV channels. Rutherford says he also has Australian patent on 'point-to-multipoints' microwave service which will use device known as 'Hungarian Horn' (transmitting antenna) to broaden beamwidth of master transmitter allowing reach to widely dispersed receive sites. Rutherford hopes to combine telephone, home security, TV delivery and other service packages into single offering and wishes to avoid aerial cables on utility poles, and burial problems experienced by Telecom in Auckland suburb fibre optic tests (see emphasis report in this issue). Acting on an Official Information Act request, the Ministry of Commerce tells **CTD** Civic Enterprises Ltd. has two license applications pending in this frequency range; one at Cobden (Greymouth) and a second at Monks Spur (Christchurch); each with 5 channels, 8 MHz wide.

Hamilton Council reportedly has adopted planning permission guidelines allowing installation (with prior approval) of 20m high poles/towers, 1m parabolic type dish and 5 square metre equipment housing in residential areas; in lieu of allowing would-be cable service operators to dig up streets or add to pole-line clutter with new (cable TV) wires. The description happens to meet the needs of PacSat's 12/13 GHz point to multipoints microwave distribution scheme for neighborhood cable projects.

SKY TV's reluctance to 'share' its rights to U.S. cable programming channels such as ESPN may be softening; at least one would-be cable operator reports ESPN may be willing to reconsider its 'exclusive' arrangement with SKY at end of 1994 contract period. SKY is also reported to be suggesting NZ$1.60 per home per month sub-licensing fee for programming from CNN. Tony Goodman of Kiwi Cable in Paraparaumu believes sports programming is 'essential' to cable TV taking off in New Zealand. "*New Zealanders must have a sports programming channel*" he notes. "SKY's parent firms (TCI et al) have prevented us from having access to ESPN. We felt we had an alternative service, Prime Sports, but then TCI went out and bought into this service and Prime Sports canceled their agreement with us." USA NBC network planning SportsChannel for satellite delivery sometime in 1994; no word yet on how TCI might keep it from New Zealand cable.

49-CHANNEL TV story appearing in *New Zealand Herald* touting 'new concept' in wireless cable (TV) may have been premature (*NZ Herald: May 11, 1993, page 1*). Story suggested 'Cellular Video' would be to television delivery what cellular phone has been to telephone companies, citing "successful trials in Brighton Beach (Brooklyn), New York and Los Angeles". In reality, field trials have only been conducted at Brighton Beach and after more than a year of operation, system has attracted 'approximately 200 subscribers' in marketplace numbering tens of thousands. System utilises experimental 28 GHz band spotting low power microwave transmitters/relays every few blocks. Subscribers have 13cm 'disc' antenna with frequency downconverter mounted in window or on roof, visual line of sight to 'neighborhood' transmitter. US FCC has not yet decided whether to grant license to service, nor where in spectrum such a service will operate if license is granted. At least one major firm is interested; New Zealand connected Bell Atlantic has agreed to be paid-in equity minority partner with US patent holders and hopes to provide system with expertise. How Auckland-based CellularVision NZ Ltd. will fare with Bell Atlantic assuming role in New York state operations is not known. New Zealand firm claimed they had purchased exclusive rights here; Bell Atlantic is part owner of (NZ) Telecom as well as SKY TV, with financial interests in fibre optic TV trials in Auckland suburbs (see primary report, this issue). Acting on an Official Information Act request filed by **CTD**, the Ministry of Commerce advises "Approaches (to Ministry of Commerce) have been received in the 27-29 GHz range for video distribution and/or interactive two way telecommunications usage over the same systems. Interest has been from Cellular Vision (Auckland based but not specific service area identified), Added Value Applications (Dr. A. Jamieson, Auckland), Fox and Associates (Christchurch based, on behalf of others, but use area not known) and

Civic Enterprises (Mr. J Rutherford, Christchurch, but for Timaru area). [None] of these has yet proceeded to license but the Ministry is prepared to license such under the Radio Regulations on individual sites as nominated in any applications received. There would be no exclusivity or long term tenure and the Ministry sees that the ventures may need some practical trials in the first instance. Commercial viability is for the applicants to judge, but in due course the relevant spectrum may be allocated by tender."

Wireless Cable, normally operating in 2.1-2.6 GHz region in most regions of the world, has been poor cousin to cable for more than decade; providing cable-like channels of service directly into homes, businesses, where cable service is not available or of poor quality. With cable rapidly growing into fibre optic based two-way industry in Europe and North America, some were forecasting empty-hour-glass scenario for wireless cable. At annual trade show recently concluded, major US firm Zenith displayed first interactive Wireless Cable technology allowing subscribers to wireless systems to communicate specific programme orders to service provider and receive on-demand customised programme packages, movies, sporting events. Two-way interconnect uses radio rather than telephone lines for ordering. In New Zealand management rights for twelve channels, each 8 MHz wide, between 2.3 and 2.396 GHz have been allocated by tender. Telecom holds rights to 8 channels, BCL 1, Sky Television 1 and Multiband Television 2. No actual use of these channels is known in New Zealand at this time but the promise of digital compression does have potential users thinking about squeezing between 4 and 8 separate programmes into a single 8 MHz channel.

New Jersey Bell (telephone) facing regulatory problems with planned introduction of video dial tone 'leased line' cable TV package. NJB seeks US government (FCC) approval to lease bandwidth capacity on new fibre/coaxial plant to cable operator who will initially take 60 of 64 (6 MHz analogue) channels for own use. FCC believes NJB is leaving no bandwidth capacity for possible future users or competitors to cable operator; NJB responds that as digital (compressed) hardware comes on line, there will be room for no fewer than 380 additional channels. US telcos are prevented from various cable TV service offerings by decree; would like to change that ruling.

FIBRE costs per km? While Telecom here variously claims as much as NZ$2M will be spent on New Lynn/Pakuranga fibre optic pilot systems, a controversial similar test in Omaha (Nebraska) has revealed the costs there for building a system very similar in capacity to Auckland suburban system(s). In a community area with 60,000 housing units, 9,000 are earmarked for the test with 500 MHz bandwidth carrying 77 analogue TV channels. In cost figures presented to FCC, lowest cost per km for newly installed fibre optic plant is NZ$2,700 while highest is NZ$8,035. In 11,000km fibre optic expansion now underway in USA, TCI is averaging just over NZ$3,100 per kilometre for installed fibre optic costs. Based upon TCI costs, Telecom here should be able to install 645 kilometres of 'pilot plant' for NZ$2M.

New York Telephone will team with cable leader Time Warner for year-test of Video Dial Tone (VDT) in three Manhattan buildings with 2,500 apartments. Firms will combine telephone and cable TV over single distribution system for tests.

Philips Consumer Electronics has agreement with interactive TV technology firm Broadband Technologies for creation of encoding/decoding technology to allow transmission of video on demand (VOD) over telephone lines. Firms will develop package allowing consumers to select specific video programming from home using 1,500 (+) source 'catalogue' with TV sets as interactive terminals.

AT&T Network Systems has announced completion of field trials combining telephone and cable TV over matrixed fibre plus coaxial distribution system. Cable Loop Carrier-500 (CLC-500) permits users to combine both communication forms; TV can be added to fibre broadband and cable can add telephone services. First full scale tests scheduled for England during 1994. US FCC, which regulates both industries, proposing that in-building (home or commercial) wiring done by either telephone or cable must be available for use by any competitor. Telephone wiring presently must be open to all comers; cable TV would be an extension of rules.

Prodigy, US based interactive computer network, has announced plans to create cable-TV-distributed compatible service.

TeleWest, UK cable operator formed by TCI (US cable giant) and US West (US telco), have completed raising NZ$527 million in financing; believed to be largest sum raised in British cable industry.

UK cable penetration is averaging 21% of all homes possible; 465,000 cable homes with 2,500,000 homes passed. Latest UK systems are combining 'cheap' telephone service with television in fibre optic plants. Industry sources predict 5.5 million UK cable subscribers by 2000.

TAIWAN now has legal cable TV industry. Country has more than 200 operating systems but until Parliament adopted legislation mid-July, they were at best quasi-legal (in absence of enabling legislation saying they could operate, they insisted there was no contrary legislation saying they could not). Approval has background that shows

strength of US movie producers; systems in operation frequently transmitted bootleg and other tapes of US movies without permission and paid no compensation for movie use. American movie producers through Motion Picture Association (of) America (MPAA) pushed US Department of State to encourage ruling Nationalist Party to create legislation that eliminated 'grey area' surrounding cable, and to establish strict guidelines which will in future prevent US movies from being used without permission and compensation. Newly formed cable association forecasting 7 million cable subscribers by 2000.

CANADIAN Paynet Telecommunications is asking Australian Broadcasting Authority for permission to construct, operate hybrid fibre optic/coaxial architecture networks in Cairns, Brisbane. Systems would 'pass' estimated 200,000 homes. In separate project, Interactive TV Australia is seeking A$173M to build fibre optic based service which would function much like cable TV elsewhere in world offering entertainment channels as well as interactive broadband services. Commitments to date, totaling approximately 12% of funding needed, are from computer technology industry.

INDIA government considering legislation to authorise cable TV industry, establish guidelines to limit their carriage of 'foreign' programming. Over past four years an estimated 2,000 entrepreneur-begun cable businesses have opened up. Indian state television (two networks) operates approximately 450 transmitters reaching an estimated 22 million receivers but most communities have 'community viewing' area where hundreds gather to watch programming fed via Insat 1-D satellite. Indian government funded creation of several thousand 'S' band satellite receive systems for community viewing in rural areas in 70s-80s and entrepreneurs developed cable augmenting limited Indian TV fare with services from Intelsat and other 'C' band (3.7-4.2 GHz) satellites. Government control of what people watch is at heart of legislation proposed; 'foreign programmes' have been attacked as undermining national culture.

QATAR, oil-enriched mini-nation on Persian Gulf, has government owned cable TV system which selects religiously compatible TV programming from off-air and via satellite for distribution to extremely well-off natives and foreign workers brought in to run country's infrastructure. Many of latter, reasonably well paid, can afford private satellite dishes and opt for these over cable since satellite programmes are not censored for content like cable programming. Qatar government has decreed henceforth private satellite dishes are 'illegal', leaving televiewers with choice of censored cable programmes, or, censored videotapes.

TV SET manufacturers marketing in US, and, cable TV industry there have reached historic accord. New TV sets will be redesigned for cable TV service interfacing and include special ports to allow simplified connection to out-of-TV-set connection of cable system provided 'descramblers'. Two industries have been battling over this point for two decades; cable opted for complete control through cable provided interface (converter/decoder) out-of-set boxes; TV set manufacturers wanted entire circuitry inside of TV sets. Cable argued they must have ability to change descrambling package at will; set makers argued for single, national descrambling standard that would be in set. In final accord, TV set makers agreed to technical changes in sets (compatible cable TV tuning, more cable-responsive tuner designs) and cable industry agreed to allow set makers to do receiving while their next generation decoders will handle only decrypting. Both sides agreed to interface jacks and cabling between two units. All of this was worked out prior to the on rush of digital television, however.

TERRESTRIAL BROADCASTING

UNLICENSED but legal 'FM broadcasting' has appeared in at least two areas on North Island. Commerce regulations (regulation 6A 1987 Radio Regulations) allow firms submitting equipment for technical approval to RFS/ROG (Technical Officer/Product Regulatory, Engineering Services, Radio Operations Group, PO Box 2847, Wellington; Tel: 04-473-2200 and FAX 04-473-2489) to distribute products after approval without individual 'station' licensing requirements. Rules allow 'Schedule C' transmitters in frequency range 100.2-100.8 MHz to radiate up to 300 milliwatts EIRP (approximately 3.2 millivolts to dipole antenna). At least two manufacturers have applied for and received ROG Laboratory certification for such devices. One, firm known as VEXX Digital FM Limited (previously known as TR Systems Ltd"?"), has packaged milli-power transmitter (TMX500)/antenna and audio playback system into 'broadcast station'. Operating in 100.2-100.8 region, where subject to power limitations such transmitters are legal, one offshoot of firm is calling itself 'Tourist FM Service' (Bay of Islands, elsewhere). Programming is designed to guide tourists with suggestions of places to see, shop or eat. VEXX also packaging equipment for retail merchants with transmission range 'adjustable' from 20m to 3km. Using digital solid-state memory, self-repeating messages from 30 seconds to 4 minutes are loaded into memory chips to advertise specials, open hours of shoppes. By careful siting of transmitters, surprising range (3km reported) is possible. (VEXX Digital FM Limited, 10 Relko Cres., Torbay, Auckland; 09-473-1818, Jay Mather.) Another firm with more ambitious plans is Tourist FM (P.O. Box 47-376, Auckland 1; 09-307-8817, Tony Skelton). They are testing 3 channel low power FM

service using 88.2, 100.4 and 100.8 MHz programmed in English, Japanese and German. Initial installation went to Taupo, others planned include Rotorua, Queenstown, Picton, Christchurch, Dunedin and Auckland. Skelton says his service, endorsed by New Zealand Tourist Board, is designed to provide local history and cultural information as well as local announcements. He is targeting camper van and rental car companies with his promotional material. He says each transmitter site could be 'downloaded' with programming material via telephone links, run essentially 'unattended'. Skelton's firm plans to own and operate all of its own transmitters and sites, has only marginal interest in others being involved at this time. Mather's firm believes they must also own the transmitters to satisfy unlicensed transmitter rules of Ministry of Commerce, but is considering setting up geographic regions where 'exclusive agents' will handle operations and be free to conduct their own businesses. If VEXX does adopt this policy, agent costs for transmitters will be message-length price sensitive; possibly around $900 for 2 minute length, $1500 for 4 minutes. VEXX uses field-changeable DRAM technology for memory. Ministry rules state any unlicensed transmitter creating interference must immediately shut down if it interferes with licensed transmitters/reception. Skelton says his three frequencies are 'assigned' but does not say by whom.

DIGITAL format test equipment, intended for terrestrial broadcasters, has begun to appear. Recognising that existing test equipment will largely be useless in tracing and proving digital format audio/video circuits through broadcasting facilities, the newest equipment samples bit rates, calculates error rates, and even provides analogue output for subjective listening or watching on existing monitoring units. Because the test equipment has to be ultra-state-of-the-art to handle the most advanced systems in the field, test equipment 'specs' offer clue to the reality of digital in broadcasting. Some examples: Grass Valley (Group) has new MCF series of video/audio analysers that can individually detect, measure parameters and print out log for up to 6 multiplexed channels of 10 bit video with as many as 4 audio channels per video programme. In the digital audio world, Australian supplier James S. Innes has the DAA-100 portable digital audio path analyser which works from 1Hz to 22 kHz and can sample and measure error and phase discrepancies by the hertz or by the phase degree. Neither firm yet reports orders from our BCL ...

AUSTRALIA reported to be studying addition of two new VHF television channels; 9A (202-209 MHz) and 12. (223-230 MHz). Australia is planning to abandon their ABC network major city channel 2 (63-70 MHz) transmitters in favour of new 9A and/or 12 channels. Major city stations have been moving off of Australian channel 0 (44-51 MHz) for past several years because of significant interference found in band I (44-70 MHz) frequency spectrum. If 9A and 12 go ahead, there will also be slight upward adjustment of channels 10 and 11 as follows: : 9 - 195 to 202 MHz; 9A-202 to 209 MHz; 10-209 to 216 MHz; 11-216 to 223 MHz; 12-223 to 230 MHz. Channels 9A-12 just happen to be the same as New Zealand 8-11. New Zealand has shown no interest in abandoning band I channels here in spite of extensive evidence it is a poor selection for TV transmission; many European countries, including the UK, moved TV out of band I a decade-plus back.

FIJI's first commercial television service will be owned by a consortium of public and private interests. TVNZ has been supplying an interim service for portions of the country pending a cabinet level decision; including nightly feeds of 6PM One Network News via Intelsat satellite. Until the formal announcement, it appeared TVNZ would play a major role in the operation of the system, possibly with an Australian partner. Under the guidelines, 51% of the company stock will be held by the Fijian provinces plus Rotuma; 49% balance will be offered for sale.

NZOA (New Zealand On Air) has agreed to use portion of broadcast licensing fees to assist TV3 in filling in TV reception areas which network claims are not economical to reach using commercial criteria. NZOA's enabling legislation assumed burden of earmarking a portion of the annual funds towards this purpose and NZOA pays TVNZ subsidiary BCL more than NZ$5M each year for undisclosed BCL 'costs' in maintaining typically .1 to 10 watt translators throughout country. Attempts by NZOA to obtain detailed accounting from BCL of how these funds are spent have failed to date. TV3's situation differs from TV1 and 2 translators covered by annual payments to BCL; TVNZ's units were in place and functional before NZOA existed and payments by NZOA cover continued operations, not initial establishment. TV3 has many such areas to cover (several hundred by one estimate) and even with NZOA funding, it will take years to catch up to TVs 1 and 2. Coromandel peninsula may be first area to be so funded.

CORRECTION:

CTD for August (93-08), page 8 under New Zealand examples reads "TVs 2 and 3, Auckland, presently operate with 325,000 kilowatts of effective radiated power." Astute reader/mathematician **Arthur C.Clarke** (Colombo, Sri Lanka) corrects us with emphasis. "*That should do a pretty good job of global warming by itself...*". Indeed. 325 kW, not 325,000 kilowatts is the correct number. Or, if you like ... 325,000 watts, not kilowatts. Mr. Clarke's recent novel, **The Hammer Of God**, punishes New Zealand for its global warming mis-deeds.

CONSUMER ACTIVITY STATISTICS

Data Compiled through 31 July 1993

	1988	1989	% +/-	1990	% +/-	1991	% +/-	1992	% +/-	1993	% to d.
B/W	12,516	7,196	(-)57%	6,473	(-)52%	12,738	(+)102	6,803	(-) 54%	1,786	(-) 14%
COLOUR	142,770	168,027	(+)118	214,728	(+)150	250,003	(+)175	258,588	(+)181	105,113	(-)74

TV SETS IMPORTED INTO NEW ZEALAND

	1988	1989	%+/-	1990	%+/-	1991	%+/-	1992	%+/-	1993	% to d.
CAMCRD	9,307	20,436	+ 220	22,920	+ 246	24,930	+ 268	30,581	+ 329	9,102	- 98(%)
VCRS	83,448	157,812	+ 189	112,499	+ 135	94,980	+ 114	94,585	+ 113	44,284	- 53
CD PLAY.	24,975	63,614	+ 255	70,661	+ 283	51,471	+ 206	81,326	+ 326	23,420	- 94

CONSUMER ELECTRONICS IMPORTED

TV sets, camcorders, VCRs (all other than camcorders), CD players (excluding video); % +/- is to **1988 base year** and % to d(ate) is to 30 June as percentage of 1988 totals. Next update through 30/09/93.

-JULY 1993 DETAIL-

Comparing 1992 averages against first 7 months of 1993, imports are well down in three of four key categories; colour TVs (off 21%), Camcorders (off 39.9%), and CD players (off 40.6%). VCRs were down by 1.9% from year ago. At the same time UK's BREMA reports gains and losses vs. 1992: colour TVs +5.7% (sets over 560cm +3.3%) while Camcorders are -15.4% and VCRs -1.4%. In USA, through 31 July EIA reports record year for imports with colour TVs +9.2%, VCRs +1.2% and Camcorders +9.9%.

For month of July in New Zealand:

1) Colour TVs: Units imported 14,028 (11.8% of YTD). Average value $586.89 ($481.93 YTD; +21.8%)

2) CD players (audio): Units 4,746 (16.9% of YTD). Average value $305.84 ($254.77 YTD; +20.0%)

3) VCRs: Units 9,742 (18.0% YTD). Average value $465.69 ($484.52 YTD; -4.1%)

4) Camcorders: Units 1,544 (14.5%YTD). Average value $1410.41 ($1,189.19 YTD; +18.6%))

In colour TVs, screen sizes 330-360 mm(14") lead in volume (23,177 to 30 June; 2,390 July), followed by screen sizes exceeding 560mm (> 22"); 15,522 to 30 June, 3,631 July. Of interest, TV receivers with screens exceeding 510mm but not exceeding 560mm, imported with**out** cabinets, amounted to 5,856 units with average value of $511.52 through 30 June, against average value of $535.05 for same size **with** cabinets. Also of interest, imports of screen sizes greater than 560cm/22" were in first place in July at 3,631 units; first month this largest size has dominated. Average landed price was $1,055.46 in July, down from $1,096.20 (-3.7%) for first 6 months.

Above And Below The Line

Overall, colour TVs, CD players and Camcorders averaged 20.13% UP in landed costs during July over average of first 6 months of 1993. Only VCRs were down in average price (-4.1% over first 6-months).

NOTE: CTD 9402 (22 February 1994) reviews the 1993 calendar year in detail for all electronic imports.

WORLDWIDE STATUS OF TECHNOLOGY
-STATUS IN NEW ZEALAND-

Current to 20 September 1993

CABLE TV/FIBRE OPTIC CABLE

World: Belgium, Canada, Netherlands, Luxembourg lead world with more than 75% of all homes cable TV connected. Analogue systems offering up to 100 channels operational in 550 MHz bandwidth not unusual, driven by wide variety of satellite delivered programming Europe/North America. World's largest cable operator (TCI: USA) rebuilding more than 11,000km existing analogue plant with fibre optic (cable) this year; will offer up to 500 channels (digital and analogue combined) in 750 MHz bandwidth. Latest cable electronics features 1 GHz bandwidth. Most rapid expansion of cable TV presently in Asia and eastern Europe where prime cable networks such as CNN, MTV, ESPN, HBO are available. In Australia, bureaucracy essentially prohibits cable TV at present time although something they call 'ITVA' (interactive television) is attempting to raise A$173 million for 'tests' of fibre optic based networking. Fibre optic laser transmitter output powers to 16 mW now top edge of art; operating bandwidths to 860 MHz and 80 analogue channels in commercial products. Estimated cable TV homes worldwide: 105 million of which 53,560,000 are in USA and 465,000 in UK (30 June).

New Zealand: Kiwi Cable TV, Paraparaumu has approximately 250 subscribers on line offering 12 channels in 330 MHz bandwidth including test of MOD (movies on demand). Kiwi cable has cut back on new plant construction at this time pending resolution of sports and other programming plans. Telecom test fibre optic system in New Lynn and Pakuranga with potential hookup to 600 homes (total) preparing to turn-on. SKY will manage most aspects of programming; 9 channels initially planned. Telecom considers this a 'pilot project' with 2+ year lifespan; hopes to interest software and interactive service providers in using test systems to gauge public response. TVNZ considering offering a cable-only 'counter-programmed' channel; a news organisation studying news-graphic (text) service. Telecom management 'split' on whether running fibre to curb or waiting on hoped-for 'ADSL' bandwidth compression break-through is correct future-choice. While waiting for technology to catch-up to hype, basic broadband fibre system is in place and available for tests. Some discussion of traditional (non-Telecom) cable in Masterton, Taupo, Greymouth, Wellington suburbs; no systems actually under construction or operating other than Paraparaumu.

DIGITAL RADIO BROADCASTING

World: Extensive testing underway using AM, AM-Digital Compatible, and FM frequencies/systems. Tests in AM broadcast band (essentially 530 kHz-1.7 MHz) universally report digital transmissions with full digital stereo cover areas equal to standard analogue with 1/100th-1/500th analogue transmission power. Digital stereo within 'AM broadcast band' may well reverse fortunes of present AM broadcasters faced with stiff competition from stereo FM broadcasters breathing new life into this group of frequencies. Gains may be temporary, however, as digital satellite broadcasting begins. Tests in FM band (essentially 88-100/108 MHz) indicate similar or better results; one Illinois (USA) test measures equal or better coverage with 100 watts as 100,000 watts analogue (30 dB difference in power levels). Stereo digital satellite-to-earth services planned 1996-97 offering 50-200 separate digital audio programme channels to 'subscribers' equipped with new digital radios and flat, circular, 'plate' antenna 15cm in diameter (fits flush on car/vehicle rooftop) at around NZ$10 per month. Services will essentially be advertising free, available over 80% of earth's surface when mature (2001-2005) reaching 99% of world's population. England has planned-for 2015 date when all band II (88-100 MHz) FM transmissions will have converted to digital in 230 MHz range. No such date set in USA yet. Germany has announced 1997 start date for DAB (digital audio broadcasting).

New Zealand: Tests, if yet conducted, have not been announced and Ministry of Commerce has 'no comment' on subject.

DIGITAL TELEVISION BROADCASTING

World: Extensive testing of systems has been conducted using VHF and UHF, microwave and satellite frequencies. All tests verify digital TV transmission is more capable of reaching homes with far higher quality pictures at vastly lower transmission powers. The UK and USA are proposing 2005-2008 period when all (present) analogue format

transmissions will cease; full time simulcasting of analogue and digital to begin late 1994 in both countries. Europe expected to adopt European digital TV 'standards' by 1 January, augmented with HDTV and widescreen standards latter half 1994. Although outcome is known, there is a procedural world-standards group vote on pivotal MPEG-2 digital basis in November which will finalise digital framework for decades to come. Under MPEG-2, maximum compression ratio is 100:1 with a compressed data rate of 5-10 Mbps. Dutch satellite service Filmnet may be pioneer to launch routine digital transmission service; scheduled November from an Intelsat satellite. Filmnet to provide its cable affiliates with Scientific Atlanta brand MPEG decoders in Holland, Belgium.

New Zealand: Ministry of Communications, which must set standards before testing might begin, has 'no comment'.

DIGITAL CONSUMER HARDWARE/SOFTWARE

Ten major VCR manufacturers have agreed-to-agree on single digital format; first consumer VCRs expected late 1995-early 1996; first digitally recorded tapes late 1995. Present (analogue) rental tapes from some New Zealand distributors will go to Macrovision technique to complicate illegal copying during 1994. Digital processing of TV signals already available in leading Panasonic (European) models; digital will do more within receivers in coming model years with first fully digital sets likely mid '94. CD products moving closer to interactive packaging with enhanced memory capacity, combo audio/graphics/video CD players now arriving in the marketplace. CD ROM/disc capacities likely to grow rapidly with improved compression technology; present .78 micron red laser standard will expand first to .523 micron blue-green laser, then under .500 micron blue laser in 1994+ period increasing audio CD play time to 170 minutes with blue-green, over 200 minutes with blue. Long awaited 'flat screen' TVs launches this spring with Mashushita 14; forecasts that 10" and unders will be LCD based, 10-20" flat screen and over 20" direct view improved short-neck CRTs at least through 1997. Camcorder 'shrinkage' not yet complete; models up to 30% smaller, lighter by end of 1994 with greater emphasis on electronic zoom/focusing to overcome physical size limits of glass lenses. Interactive CD 'reality' programmes (including games) will drive software marketplace through 1994-5. Philips CD-i video CDs launch in next 60 days; some unresolved problems with ability of audio CD players + 'adapter' to also play video CDs. Limits of digital compression some years from ultimate and as this technology matures, everything digital will continue to mature.

Australian Telecom is major sponsor of new worldwide group working on defining just what a 'worldwide/global' multimedia network might include. More than 50 nations, mostly represented by their telephone companies, have met in France to form 'working groups' to assess just where the rush to a digitally-based audio/video/data/computer world is headed; and of course how telephone companies can best be positioned to not only participate, but to dominate the expected merging of technologies. One of the first challenges facing the group is reassessing the existing standards for interconnection of systems and formats and trying to negotiate a common set of protocols for use worldwide.

SATELLITE TO HOME BROADCASTING

Fully compressed digital 150 channel Ku band direct-to-home launching first half 1994 in North America is leading edge technology. Asia/Pacific forecast to have explosive growth in satellite transponder availability by 1997 (700 C and Ku band transponders available) but not more than 20% of these will 'footprint' New Zealand. Presently New Zealand has fewer than 10 'functional transponder footprints' and they are pre-sold to users little interested in New Zealand proper. Four new satellites with 79 new New Zealand capable transponders scheduled to launch into orbit during 1994; another 24 in 1995. Australia represents more than 60% of (south) Pacific potential satellite market for TV programming; government there presently unclear on whether it will allow non-Australian satellites to provide service within country. Five (of five) Ku band transponders designed by Australian Optus to provide New Zealand coverage to dishes under 1 metre here are without use. The promise of Australia's newest Optus generation Ku band satellites temporarily lost in their loss of second new generation satellite, during launch, this past January. Additional Australian complications: government unable to decide on future of DTH (direct to home) satellite broadcasting. 3+ metre New Zealand Ku band dishes have very limited access to a few hours of specialized programming from Optus at present time, 'spilling over' from Australian southeast beam coverage. Intelsat aging C band satellites (three) provide CNN, ESPN (scrambled but accessible for fee), U.S. ABC/CBS/NBC feeds (mostly news, sports programming), French RFO (for Tahiti), Worldnet and limited BBC fare with dishes 3.5 metres and larger. New Zealand equipment sellers/installers mostly 'part-time', equipment markups excessive which curtails consumer interest. There are no legal impediments in New Zealand to home ownership of TVRO dish systems. Europe, southeast Asia enjoying 'home satellite' boom with explosive growth in hardware sales, programming start-ups.

Typical Bangladesh TVRO owner has access to more than 40 fulltime satellite TV channels, compared to New Zealand's one fulltime (CNN) and 7 part-time. The next five years in worldwide satellite broadcasting will be digitally-driven with wholesale changeover to digital transmission from present analogue expected by 1998. Because one satellite transponder can handle up to 10 (now; more soon) TV programmes, versus one or two analogue, programme channels available will multiply by 4-10 in same period.

ESPN, the primary sports feed to SKY Sports, is available through SKY to home dish owners in New Zealand who live outside of SKY service regions. A Scientific-Atlanta B-MAC receiver-decoder is required ($2,900 through SKY; Brian Green at 579-9999) for openers. There is a monthly fee ($40 to $200 depending upon how 'commercial' your application) and arrangements are made through SKY's Tony O'Brien. One downside; ESPN (International) on Intelsat could be amongst the first to convert to digital video rendering the B-MAC portion of your S-A receiver useless. Same SA B-MAC units are used in Australia; SKY does not care if you do not buy unit from them.

New Zealand's SKY TV is reported to be studying satellite distribution of programming; is known to have concluded talks with Optus/Aussat and believed to have held recent talks with PanAmSat concerning possible use of PAS-2 (Pacific) satellite when available late-94. Via satellite, SKY could opt for South Pacific coverage in addition to basic New Zealand footprint(s) although firm's execs profess little interest in coverage outside of New Zealand. Like so many television projects at this time, with digital approaching, there is a time to play your hand, a time to hold your hand ...

TERRESTRIAL/SKY TO HOME IN NEW ZEALAND

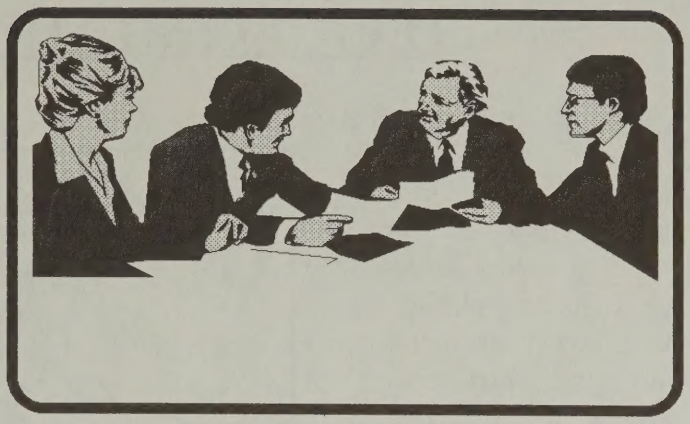
VideoCrypt encoded SKY TV presently claims more than 103,000 subscribers; is expanding service into new areas. Sky has grown from 53,000 (mid '92) and hopes for 200,000 by mid-94. Expansion includes Hawkes Bay (December), Dunedin (February), Manawatu (March), Invercargill (April) and Wanganui (June). SKY will not confirm (nor deny) Whangarei likely to be next announced expansion region (late '94). SKY claims no new service channels are in near-term; observers suggest SKY is watching digital TV (hardware) developments in USA and may benefit from use of digital hardware by its USA owners TCI and Time (cable firms). SKY has additional frequencies available nationwide, could digitally simulcast all three present channels plus one or more new program services combined in a fourth channel if it wished; offering 'tiered' service via digital transmission as way of phasing out of analogue. Although SKY has acquired 'HBO name rights' little or no HBO film/special product has appeared in New Zealand to date, fueling speculation SKY may opt to break out an 'HBO Channel' in future at extra monthly fee. In USA, HBO typically retails in NZ$15 range monthly. In 1992, SKY was marketing-oriented spending equivalent of $62.38 per subscriber during year (at mid-92 53,000 subscriber level) in media advertising blitz ($3,306,000 spent in 1992). SKY's VideoCrypt this winter has experienced a few 'teething' problems with (smart) cards, resorting to level one (decoder required) rather than level two (smart card required) encryption. Evening 'news block' may expand to include Australian network programming this spring.

TV3 expansion to reach approximately 200,000 new potential viewers now underway in Bay of Plenty, Kapiti Coast, Oamaru, Wanganui, South Island. Significant large geographic regions (west coast South Island, all north of Whangarei, North Island) will remain unserved plus numerous 'pockets' with terrain shielding. Recently announced NZOA funding assistance, to help TV3 expand into smaller rural areas, could have marginal impact on TV3 national coverage by mid to late 1994. Attempts to beef-up news (an attractive profit centre for advertising) have been disappointing; John Hawkesby 6PM news attracting under 10% of viewers against established TV1 news in same time block.

Ethnic/cultural groups 'demanding' funding from NZOA and local public bodies attempting to create new public, non-commercial channels in Auckland, Waikato, Bay of Plenty. Costs, if BCL sites and leased equipment are used, major hurdle. One proposal calls for leasing of existing TAB facility during non-racing hours as 'test' of programming acceptance by public and long-term funding. The Labour Party has issued 'paper' endorsing public channel concept.

United Christian Broadcasting, holder of UHF frequencies nationwide, would like to be operational by 1994 in at least Auckland. Announcements to date have sent 'mixed' signals regarding planned programming, funding available.

ABOUT YOUR FRIENDS . . .



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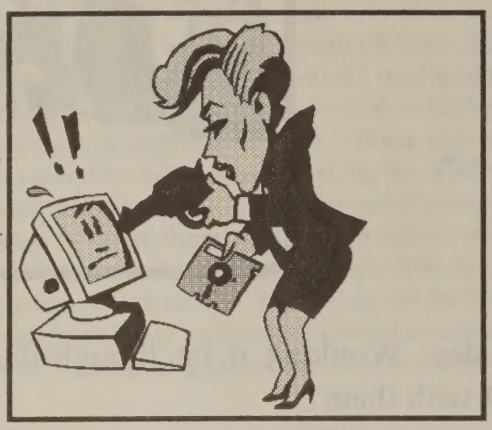
ON KILLING THE MESSENGER

Being in business is all about adapting to change. In one lifetime the communications industry has experienced more change than during all previous recorded history. In less than ten years the phrase *digital* has crawled out of obscurity into the mainstream of business life. There is every indication the digital revolution is accelerating; changes forecast for the year 2010 are now virtually upon us. The



world of telecommunications, and, the art of communicating are merging into a single science form with common instruments of implementation. Will these new instruments *look like* a television set, *function like* a telephone and have the ability and speed of a computer? Will telephone companies *replace* television companies as entertainers? Will computer companies *replace* telephone companies as communicators? OR, will there be a single, giant entity that informs, entertains, educates and communicates between all men and women of the planet no matter how remote their location, how tiny their society?

HISTORY will record the 1990s as "The Digital Decade"; that period in man's development where analogue technology was upgraded to digital technology. History will record that some adapted to the change while others continued making horse shoes and wagon wheels until there were no horses left to shoe, no wagons left rolling.

DIGITAL is here; like it or not. Adapt to it or be buried by it. The choice is yours.

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